



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 96

Washington: 1946

No. 3200

EIGHT NEW SPECIES OF CHALCID-FLIES OF THE GENUS PSEUDAPHYCUS CLAUSEN, WITH A KEY TO THE SPECIES

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THE species of chalcid-flies of the genus *Pseudaphycus* Clausen (family Encyrtidae) are apparently all parasites of pseudococcine scale insects, and some of the species are known to be of considerable economic importance through the control they exercise over their hosts. *P. utilis* Timberlake is credited with having all but exterminated *Pseudococcus nipae* (Maskell) in Hawaii, and the new species *malinus* (described on a subsequent page of this paper), which was introduced into the eastern United States from Japan to combat *Pseudococcus comstocki* (Kuwana), apparently gives promise of bringing that serious orchard pest under control.

The genus is widely distributed. Species are now known to occur in Austria, Spain, Canary Islands, Cuba, Puerto Rico, the United States from New Jersey to California, Hawaii, Korea (Chosen), and Japan.

Pseudaphycus belongs to the group of genera related to *Aphycus* Mayr. It may be distinguished from *Aphycus* as well as most of the other related genera by the fact that it has only five, instead of six, segments in the antennal funicle. It is most closely related to *Bothriocraera* Timberlake and *Acerophagus* Smith, both of which have the funicle 5-segmented. It may be separated from *Bothriocraera* by the dull sculpture of its frontovertex and thoracic dorsum and by the fact that it is never shining black in color. As pointed out by Mercet (Bull. Ent. Res., vol. 28, p. 317, 1937), the differences between *Pseudaphycus* and *Acerophagus* are very slight. About the only real differences seem to be that in *Acerophagus* the frontovertex is less than

twice as long as wide, the ocellar triangle is more or less obtuse, and the antennae are unicolorous and always pale, while in *Pseudaphycus* the frontovertex is nearly always two or more times as long as broad, the ocelli are arranged in an equilateral or acute triangle, and the antennae are always contrastingly colored with the scape, pedicel, and at least some of the funicular segments black or fuscous and the club white.

The species of *Pseudaphycus* offer very few good characters for their separation. Slight differences in sculpture are hard to define and differences in color consist largely of differences in shades of yellow, since all the species are yellowish sometimes varied with admixtures of blackish or fuscous. The following key to species is offered as an aid to identification but should be supplemented by comparison with types or authentically determined specimens whenever possible:

KEY TO THE DESCRIBED SPECIES OF PSEUDAPHYCUS

FEMALES

1. Pedicel of antenna as long as or longer than first three segments of funicle combined, funicular segments from first to last successively increasing in width and all more or less transverse----- 2
 Pedicel of antenna not longer than first two funicular segments combined; first funicular segment small, transverse, narrower than pedicel; segments 2 to 5 of funicle subquadrate, subequal, and each a little broader than pedicel----- 1. *meritorius*, new species
2. Ovipositor exerted one-fifth to nearly one-half length of abdomen----- 3
 Ovipositor extending barely beyond apex of abdomen, at most distinctly less than one-sixth length of abdomen----- 2. *prosopidis* Timberlake
3. Wings hyaline; scape not expanded beneath----- 4
 Wings at least faintly fuscous; scape often but not always somewhat thickened or slightly expanded beneath----- 5
4. General color pale lemon-yellow; hairs on mesoscutum white; ocellar triangle rather small and nearly equilateral; ovipositor exerted about one-third length of abdomen ----- 3. *graminicola* Timberlake
 General color bright orange-yellow; hairs on mesoscutum dark brown or blackish; ocellar triangle obviously acute and unusually large; ovipositor exerted about one-fifth length of abdomen----- 4. *utilis* Timberlake
5. Forewing fuscous with a more or less distinct paler hyaline or subhyaline transverse streak beyond apex of stigmal vein; scape obviously a little thickened or broadened----- 6
 Forewing uniformly fuscous or subfuscous, without a paler transverse streak; scape usually slightly thickened but sometimes cylindrical----- 9
6. Anterior ocellus at center of frontovertex; speculum of forewing not interrupted; mesoscutum, axillae, and scutellum bright orange-yellow, with a conspicuous narrow transverse band of black at anterior margin of mesoscutum ----- 5. *websteri* Timberlake
 Anterior ocellus distinctly above center of frontovertex; speculum of forewing interrupted a little behind middle; mesoscutum, axillae, and scutellum more or less dusky orange to blackish yellow, anterior margin of mesoscutum with suture sometimes blackish but never forming a conspicuous and well-defined transverse band----- 7

7. Mesoscutum, axillae, scutellum, and abdomen blackish yellow; lateral borders of mesoscutum white; posterior ocelli as far from anterior ocellus as from margin of occiput; inner orbits parallel for whole length of frontovertex. 6. *maculipennis* Mercet
- Mesoscutum, axillae, and scutellum dusky orange-yellow; lateral borders of mesoscutum not white; posterior ocelli a little more distant from anterior ocellus than from margin of occiput; inner orbits diverging very slightly below.----- 8
8. Frontovertex about two and one-half times as long as broad; head and thorax dorsally rather pale orange-yellow, axillary sutures of metanotum usually not blackish.----- 7. *angelicus* (Howard)
- Frontovertex fully three times as long as broad; head and thorax dorsally a deeper shade of orange-yellow mixed with blackish, and axillary sutures brownish black.----- 8. *abstrusus*, new species
9. Middle and hind tibiae each with two fuscous or blackish bands.----- 10
- Middle and hind tibiae without fuscous bands.----- 12
10. Frontovertex as broad as long or somewhat broader than long; ocelli in an equilateral triangle; dorsum of thorax dirty yellow; antenna fuscous with first funicular segment and club white.----- 9. *austriacus* Mercet
- Frontovertex twice to two and one-half times as long as broad; ocellar triangle at least slightly acute; dorsum of thorax orange-yellow, antennal scape yellowish below, brown above; pedicel and funicle brownish or fuscous, fifth funicular segment and club white.----- 11
11. Ocellar triangle distinctly acute, posterior ocelli about half as far from each other as from anterior ocellus; speculum of forewing interrupted below middle.----- 10. *orientalis* Ferriere
- Ocellar triangle nearly equilateral; posterior ocelli only slightly closer to each other than to anterior ocellus; speculum of forewing not interrupted. 11. *malinus*, new species
12. Last two segments of funicle (sometimes entire funicle) and club white, first three segments of funicle usually fuscous; frontovertex unusually narrow, fully three times as long as broad; ocelli in a very acute triangle, posterior pair separated by about diameter of an ocellus; ovipositor one-third to half as long as abdomen.----- 12. *angustifrons*, new species
- Entire funicle black or at least fuscous; frontovertex at least a little broader; ocellar triangle less acute and posterior pair of ocelli separated by more than diameter of an ocellus; ovipositor usually shorter.----- 13
13. Mesoscutum, scutellum, and axillae weakly sculptured, distinctly shining; dorsum of thorax dirty yellowish or grayish in color; antennal club blackish basally.----- 14
- Mesoscutum, scutellum, and axillae finely and densely sculptured, dull; dorsum of thorax orange-yellow; antennal club entirely white.----- 15
14. Scape of antenna obviously a little thickened or expanded beneath; ovipositor exerted one-third length of abdomen; speculum of forewing uninterrupted. 13. *mundus*, new species
- Scape of antenna not obviously expanded; ovipositor about one-fifth length of abdomen; speculum at least partially interrupted a little behind middle. 14. *limatulus*, new species
15. Anterior margin of face narrowly dark brown or blackish, forming a dark transverse line between bases of mandibles; occiput except around margins black or blackish, anterior face of pronotum mostly black; suture between pronotum and mesoscutum blackish; tegula pale at base, blackish apically; abdomen dorsally mostly blackish; posterior tibiae often with two fuscous bands.----- 11. *malinus*, new species

- Anterior margin of face without a dark line between bases of mandibles; head and thorax dorsally bright orange-yellow without any blackish markings; tegula white; abdomen with four rather definite dark transverse bands, one of which connects vibrissal plates, one basad of this and two apicad of it; hind tibiae not banded..... 16
16. Frontoververtex bright orange-yellow and very finely granulosely sculptured with only very faint indication of alveolation even under high magnification..... 15. *meracus*, new species
- Frontoververtex paler, dilute orange-yellow, entire surface covered with fine but very distinct facetlike punctures..... 16. *alveolatifrons*, new species

1. *PSEUDAPHYCUS MERITORIUS*, new species

The subquadrate second to fifth segments of the funicle distinguish this species from all other species treated here.

Female.—Length 0.92 mm. Frontoververtex, mesoscutum, axillae, and scutellum slightly dusky orange-yellow; head (except frontoververtex), tegulae, pronotum, all pleura, and sterna and all legs yellowish white; propodeum fuscous; abdomen dorsally yellowish with four transverse fuscous bands, the anterior two bands coalesced at the lateral margins of abdomen and enclosing an ellipsoidal area between the cerci, the posterior two bands straight; abdomen beneath fuscous to blackish medially with the margins pale, ovipositor pale at base, darker apically; eyes black; ocelli dark red; antennal scape pallidofuscous; pedicel and entire funicle black or blackish; club white; wings uniformly faintly fuscous, or subhyaline; marginal and stigmal veins dark fuscous, submarginal vein pale.

Frontoververtex a little less than twice as long as broad, granulosely punctate; inner orbits parallel; ocelli in an equilateral triangle; anterior ocellus situated only slightly above middle of frontoververtex; lateral ocellus less than its own diameter from margin of eye and about its own diameter from occipital margin; eyes clothed with short hairs. Antenna clavate; scape not expanded beneath, five to six times as long as thick; pedicel nearly twice as long as thick and less than one-third as long as scape; first funicular segment small, narrower than pedicel; segments 2 to 5 of funicle subequal and subquadrate, and each a little thicker than pedicel; club a little thicker than funicle and approximately as long as the four preceding funicular segments combined.

Mesoscutum, axillae, and scutellum finely granulosely punctate, mat; propodeum in front of spiracle weakly reticulated, elsewhere smooth; pleura weakly reticulated, slightly shining. Forewing with nearly uniform, rather dense discal ciliation; speculum closed at posterior margin of wing but otherwise uninterrupted; marginal vein punctiform; postmarginal vein shorter than stigmal.

Abdomen short-ovate in outline, about as long as thorax or slightly longer, slightly narrower than thorax; weakly reticulately sculptured

and more or less distinctly shining dorsally and with similar sculpture ventrally. Ovipositor exerted one-fourth to one-third the length of abdomen.

Male.—Length 0.8 mm. Similar to female except as follows: Funicular segments subequal in length, but successively increasing in width from first to last, the fifth about as broad as pedicel and a little broader than long; club nearly as long as funicle; abdomen shorter than thorax, nearly circular in outline, blackish dorsally and ventrally with yellowish lateral margins above and beneath except at cerci, where the black on dorsum extends to the margins.

Type locality.—Winchester, Va.

Type.—U. S. N. M. No. 57324.

Remarks.—Described from numerous specimens received from D. W. Clancy of the Charlottesville, Va., laboratory of the Bureau of Entomology and Plant Quarantine and said to have been reared from *Pseudococcus virgatus* (Cockerell) collected at Winchester, Va., June 20, 1944, and recorded under laboratory note Nos. 676, 677, 678, and 681. Other specimens identified as this species were reared from the same host collected at Winchester, May 31, 1944, under laboratory No. 638; August 4, 1943, laboratory No. 529; August 3, 1944, laboratory No. 850; and at Hamilton, Va., August 12, 1943, laboratory No. 530, and May 30, 1944, laboratory Nos. 634 and 635.

2. PSEUDAPHYCUS PROSOPIDIS Timberlake

Pseudaphycus prosopidis TIMBERLAKE, Proc. U. S. Nat. Mus., vol. 50, p. 571, 1916.

Described from Mesilla, N. Mex., as a parasite of *Pseudococcus prosopidis* (Cockerell).

3. PSEUDAPHYCUS GRAMINICOLA Timberlake

Pseudaphycus graminicola TIMBERLAKE, Proc. U. S. Nat. Mus., vol. 50, p. 570, 1916.

Recorded by Timberlake as parasitizing pseudococcine scales on *Stipa* sp. at Las Vegas, N. Mex., and on *Elymus condensatus* at Kimballs, Utah. The host insect involved in the record from *Stipa* sp. has recently been identified by Morrison as *Trionymus neomexicanus* var. *utahensis* (Cockerell). The host on *Elymus* remains unidentified.

4. PSEUDAPHYCUS UTILIS Timberlake

Pseudaphycus utilis TIMBERLAKE, Proc. Hawaiian Ent. Soc., vol. 5, p. 323, figs. 1-4, 1923.—SWEZEY, Proc. Hawaiian Ent. Soc., vol. 5, p. 301, 1923.—TIMBERLAKE, Proc. Hawaiian Ent. Soc., vol. 5, p. 431, 1923.—WILLIAMS, Handbook of Insects and other Invertebrates of Hawaiian sugar cane fields, p. 255, 1931.—SWEZEY, Proc. 5th Pacific Sci. Congr. (Canada, 1933), vol. 5, p. 3532, 1934.—FEMBERTON, Hawaiian Planters Rec., vol. 45, p. 109, 1941.—ANON., Puerto Rico Exp. Stat. Rept. for 1940, p. 68, 1942.

This species is a parasite of *Pseudococcus nipae* (Maskell) and was originally described from the state of Veracruz, Mexico. It was intro-

duced into Hawaii in 1922 where, according to Pemberton, it proved so efficient as practically to exterminate its host. More recently it was introduced into Puerto Rico where, according to the above-cited report of the Puerto Rican Experiment Station, it gives every indication of bringing the host insect under complete control.

5. PSEUDAPHYCUS WEBSTERI Timberlake

Pseudaphycus websteri TIMBERLAKE, Proc. U. S. Nat. Mus., vol. 5, p. 570, 1916.

Known only from the type, a single female, said to have been reared from the stems of *Elymus virginicus*, at Villa Ridge, Ill. The real host was probably a pseudococcine scale on the *Elymus*, as Timberlake pointed out.

6. PSEUDAPHYCUS MACULIPENNIS Mercet

Pseudaphycus maculipennis MERCET, Bol. Real Soc. Espan. Hist. Nat., vol. 23, p. 140, fig. 2, 1923; Rev. Espan. Ent., vol. 1, p. 12, fig. 1, 1925.

Originally described from material collected on the island of Tenerife, Canary Islands. Mercet later collected it at Barcelona, Spain. No host has as yet been recorded for the species.

7. PSEUDAPHYCUS ANGELICUS (Howard)

Aphycus angelicus HOWARD, Proc. U. S. Nat. Mus., vol. 21, pp. 241, 245, 1898.

Pseudaphycus angelicus (Howard) TIMBERLAKE, Proc. U. S. Nat. Mus., vol. 50, p. 573, 1916.—CLAUSEN, Univ. California Techn. Bull., Entom., vol. 3, pp. 258, 280, 1916.—FLANDERS, Journ. Econ. Ent., vol. 28, p. 552, 1935; vol. 33, p. 758, 1940.

P. angelicus was originally described from Los Angeles, Calif., as a parasite of *Pseudococcus* sp. on passionflower. It has since been recorded by Timberlake as parasitizing *Pseudococcus* (*longispinus* Targioni) = *adonidum* (Linnaeus), *ryani* (Coquillett), and (*citrophilus* Clausen) = *gahani* Green; by Clausen from *Pseudococcus maritimus* (Ehrhorn) and *gahani* Green; and by Flanders from *Pseudococcus adonidum* (Linnaeus) and *Phenacoccus gossypii* Townsend and Cockerell. All these records are of occurrences of the species in California, and thus far it is not known to occur outside of that State.

Timberlake has given a satisfactory description of this species in the paper cited above, except that it should be noted that the transverse fuscous band on the cheeks which he mentions is not always present.

8. PSEUDAPHYCUS ABSTRUSUS, new species

The specimens to which this name is here assigned have proved exceedingly puzzling (hence the specific name).

Female.—Length 0.94 mm. Apparently agreeing in every respect with females of *angelicus* except that the frontovertex is very slightly narrower than in that species, and the general color is somewhat

darker, dirty orange-yellow, with the anterior margin of mesoscutum as well as the axillary sutures blackish and the metanotum, propodeum, and entire dorsum of abdomen deeper black. The color of antennae, underparts of the head and thorax, tegulae, wings, and legs is as in *angelicus*.

Male.—Length 0.8 mm. The single male specimen available for study has the antennal pedicel, first funicular segment, and the entire club white, the remainder of antenna black. In *angelicus* the pedicel is brownish, the first two segments of the funicle white, and the club mostly white but with its base narrowly blackish. Otherwise I can see no differences.

In both *angelicus* and *abstrusus* the frontovertex is densely and very finely alveolately sculptured, the alveoli very minute and discernible as such only under high magnification. This sculpture is very similar to that found in *alveolatifrons*, new species, described beyond, but in that species the alveoli are coarser and more distinct, the frontovertex is broader and shorter, and the ocelli are arranged in an equilateral instead of a distinctly acute triangle.

Type locality.—Roseland, Va.

Type.—U.S.N.M. No. 57325.

Remarks.—The holotype female and one female paratype were collected by D. W. Clancy, August 1, 1944, at Roseland, Va., on the bark of an apple tree infested with mealybugs and bear laboratory No. 745. The male allotype and one female paratype are labeled as having been reared from *Pseudococcus comstocki* (Kuwana) collected October 18, 1944, by Clancy at Colesville, Va., and bear laboratory Nos. 855 and 856, respectively.

9. PSEUDAPHYCUS AUSTRIACUS Mercet

Pseudaphycus austriacus MERCEZ, Rev. Espan. Ent., vol. 1, p. 13, fig. 2, 1925.

The type locality is Weyer, Austria. No host is known.

10. PSEUDAPHYCUS ORIENTALIS Ferriere

Pseudaphycus orientalis FERRIERE, Bull. Ent. Res., vol. 28, p. 315, fig. 1, 1937.—LE PELLEY, Trans. Roy. Ent. Soc. London, vol. 93, p. 82, 1943.

This species was originally described as a parasite of *Pseudococcus lilacinus* (Cockerell) collected at Los Baños, Luzon, Philippine Islands. Le Pelley gives an account of its habits and biology.

11. PSEUDAPHYCUS MALINUS, new species

Aphycus sp. HAEUSSLER and CLANCY, Journ. Econ. Ent., vol. 37, p. 504, 1944.

The description of *orientalis* Ferriere fits this species in many particulars but differs in respect to the ocellar triangle and the speculum of the wing. In *orientalis* the ocellar triangle is said to be acute, "the hind ocelli half as far from each other as from the front ocellus," and the wing is said to have "the hairless streak interrupted below the

middle." In *malinus* the ocellar triangle is somewhat acute, but the posterior ocelli are only slightly closer to each other than to the front ocellus and the hairless streak is not interrupted. One inconspicuous but seemingly constant character distinguishing *malinus* from all other species examined is that the clypeus has a very narrow brownish or blackish anterior border which constitutes a nearly straight and continuous dark line between the bases of the mandibles.

Female.—Length 0.9 mm. Frontovortex, mesoscutum, axillae, and scutellum dirty orange-yellow; temples, cheeks, and face below frons whitish except for a very narrow brownish or blackish line along the oral margin between bases of mandibles; occiput above the neck more or less blackish; antennal scape, pedicel, and funicle dark brownish or fuscous, the last funicular segment usually mostly whitish; club white; apices of mandibles dark brown; eyes black; ocelli dark reddish; pronotum whitish above, its anterior face in large part blackish; anterior margin of mesoscutum along the suture narrowly blackish; scutellum frequently with indications of an obscure brownish transverse band before apex; tegulae pale basally, fuscous apically; all legs and underside of thorax whitish, the middle and hind tibiae sometimes each with two more or less distinct fuscous bands; propodeum and dorsum of abdomen dark brown, the latter with a narrow transverse band of blackish at about basal one-third; under side of abdomen blackish with broad whitish margins. Forewing subhyaline, with a faint fuscous cloud behind the stigmal vein but without a hyaline band.

Frontovortex about two and one-half times as long as broad, granulosely sculptured; inner orbits parallel; ocelli in a nearly equilateral triangle, the posterior ocelli slightly closer to each other than to the anterior ocellus; ocellocular line equal to about half the diameter of an ocellus; anterior ocellus situated distinctly above middle of frontovortex; eyes clothed with short hairs. Antennae strongly clavate; scape subcylindrical, approximately four times as long as thick; pedicel about one-third as long as scape and subequal to first four funicular segments combined; funicular segments all transverse and successively increasing in width from first to last, the fifth segment fully twice as wide as the first; club solid, distinctly wider than last funicular segment and approximately as long as pedicel and entire funicle combined.

Mesoscutum, axillae, and scutellum finely sculptured, mat, and clothed with short pale hairs; propodeum very faintly reticulated, shining; mesopleuron with very fine and weak reticulation. Forewing with short dense discal ciliation distad of speculum, the cilia basad of speculum longer and not quite so dense; speculum closed at posterior margin of wing by about three rows of hairs, otherwise not inter-

rupted; marginal vein punctiform; stigmal vein longer than marginal and postmarginal combined.

Abdomen about as long and as broad as thorax, short-ovate to nearly circular in outline, weakly reticulated and more or less shining dorsally and ventrally; ovipositor exerted approximately one-sixth to one-fifth the length of abdomen.

Male.—Length 0.75 mm. Like female in all respects except that frontovertex is only about twice as long as broad, anterior ocellus only slightly above middle of frontovertex, and abdomen a little shorter and narrower than thorax.

Type locality.—Winchester, Va.

Type.—U.S.N.M. No. 57326.

Remarks.—The holotype female, allotype, and a larger number of paratypes of both sexes were reared by D. W. Clancy from *Pseudococcus comstocki* (Kuwana) collected August 11, 1943, at Winchester, Va., and recorded under Charlottesville, Va., laboratory No. 557.

This species was introduced from Asia into Virginia and several other eastern States in 1941–42 by the Bureau of Entomology and Plant Quarantine to combat the Comstock mealybug. Numerous specimens of the species reared from *P. comstocki* collected by R. W. Burrell and C. P. Clausen in Japan and Chosen have been examined and compared with the types, but since none of this Asiatic material is in first-class condition the description has been drawn from specimens representing recoveries of the species in Virginia. Since its original introduction specimens have been distributed for colonization in other localities, and the National Collection now contains material representing recoveries at the following points: Batesville, Berryville, and Hamilton, Va.; Proctorville, Ohio; South River, Morganville, and Moorestown, N. J.; Branford, Guilford, and Meriden, Conn.; and Bridgeville, Del.

12. PSEUDAPHYCUS ANGUSTIFRONS, new species

The unusually narrow frontovertex will distinguish this species from all others known to me.

Female.—Length 0.8 mm. Frontovertex light orange; occiput more or less blackish above the neck; eyes black; ocelli dark red; remainder of head whitish. Antennal scape and pedicel black or blackish, the scape usually pale at base and sometimes with the dorsal margin pale; first three segments of funicle more or less fuscous, fourth and fifth segments white; club white. Pronotum whitish dorsally and laterally but with anterior face mostly blackish; mesoscutum, axillae, and scutellum brownish orange, with the sutures darker; propodeum dark brown; pleura, sterna, and all legs whitish; abdomen dorsally dark brown with whitish margins, ventrally entirely white. Wings uniformly faintly fuscous; marginal vein dark fuscous, other veins paler.

Frontovortex unusually narrow, fully three times as long as broad, granulosely punctate; inner orbits parallel or very nearly so; ocellar triangle strongly acute, posterior ocelli separated by a distance equal to about one to one and one-half times the diameter of an ocellus, nearly twice as far from anterior ocellus as from each other, almost touching the eye margins and a little more than the diameter of an ocellus from the occipital margin; anterior ocellus situated a little above the middle of frontovortex; eyes large, with very short and inconspicuous pile. Antennae strongly clavate; scape distinctly a little expanded beneath, widest beyond middle, very slightly less than four times as long as broad; pedicel about one-third the length of scape and about equal to first four segments of funicle combined; funicular segments all wider than long, successively increasing in width from first to last, the first segment narrower than pedicel, the fifth segment the largest and about twice as broad as long; club solid, distinctly broader than last funicular segment, and approximately as long as pedicel and funicle combined.

Mesoscutum, scutellum, and axillae finely sculptured but not wholly mat, clothed with short whitish hairs; propodeum smooth and shining; mesopleuron weakly sculptured. Forewing with speculum closed at posterior margin of wing and also interrupted a little behind the middle; discal ciliation distad of speculum short and moderately dense, proximad of speculum a little coarser and not quite so dense; marginal vein punctiform, postmarginal a little longer than marginal, stigmal distinctly longer than marginal and postmarginal combined.

Abdomen as broad as thorax and usually a little longer than thorax, ovate, weakly sculptured dorsally, smooth and shining ventrally; ovipositor sheaths exerted about half the length of abdomen.

Male.—Length 0.7 mm. Closely resembling female but with frontovortex only slightly more than twice as long as broad; anterior ocellus located very nearly at middle of frontovortex; abdomen no longer than thorax and subcircular in outline.

In some specimens of both sexes the prescutum is narrowly bordered anteriorly with black and in some males the ocellar triangle is blackish.

Type locality.—Cuba.

Type.—U.S.N.M. No. 57327.

Remarks.—Described from 26 females and 4 males, all intercepted at quarantine, at three different ports of entry, on shipments of pineapples originating in Cuba and in each case infested with mealybugs (probably *Pseudococcus brevipes* Cockerell). In most instances the parasites were actually reared from the mealybugs. The holotype female and two female paratypes were reared at Detroit, Mich., April 18, 1932, by W. W. Wood, under Detroit No. 1094. The allotype and three female paratypes were reared April 28, 1936, at New York, and

bear New York No. 58589. Other paratypes were intercepted May 13, 1936, under New York No. 59153; December 28, 1932, under New Orleans No. 5953; June 3, 1934, under New Orleans No. 8715; April 20, 1936, under New Orleans No. 17320; May 22, 1934, under New Orleans No. 8488; and April 28, 1936, under New York No. 58577.

13. PSEUDAPHYCUS MUNDUS, new species

Pseudococcobius terryi (Fullaway) BYNUM (not *terryi* Fullaway), Journ. Econ. Ent., vol. 30, pp. 756-761, 1937.

Pseudaphycus sp. nov. WOLCOTT, Insectae Borinquenses, pp. 128, 529, 1936.

This species closely resembles *angelicus* (Howard) but may be distinguished from that species by the fact that the forewing is more weakly and more uniformly infuscated, without a transverse hyaline band, and the speculum is not interrupted. The female differs further from *angelicus* by having the antennal club black or blackish at base instead of entirely white. The male differs from the male of *angelicus* by having the entire funicle of the antenna nearly uniformly pale grayish instead of mostly black with the first two segments only pale.

Female.—Length 1.1 mm. Frontovortex, mesoscutum, axillae, and scutellum dilute orange with a slight dusky tinge; head except frontovortex, tegulae, pronotum, entire underside of thorax and all legs white or whitish; propodeum and dorsum of abdomen blackish, abdomen beneath whitish; ovipositor pale at base, black at apex; eyes brownish black, ocelli dark reddish; occiput immediately above the neck more or less infuscated and suture between pronotum and mesoscutum often fuscous; antennal scape black with a white dorsal margin; pedicel, entire funicle, and usually the greater part of basal segment of club black; last two segments and apex of first segment of club pure white; wings uniformly faintly fuscous, almost hyaline. Hairs on mesonotum white.

Frontovortex two and one-half to three times as long as broad, granulosely punctate; inner orbits practically parallel; ocelli in a slightly acute triangle; anterior ocellus situated distinctly above the middle of frontovortex, lateral ocellus about its own diameter from eye margin; eyes clothed with short pile. Antenna strongly clavate; scape distinctly a little expanded beneath, about four times as long as broad; pedicel a little more than one-third as long as scape and nearly equal in length to four following segments of funicle; funicular segments all strongly transverse, subequal in length but successively increasing in width, the fifth segment approximately twice as wide as the first and three times as broad as long; club large, indistinctly 3-segmented, broader than last funicular segment, and as long as or a little longer than entire funicle.

Mesoscutum, axillae, and scutellum weakly sculptured, rather distinctly shining and sparsely hairy; propodeum smooth; mesopleuron

uniformly weakly reticulated. Forewing with discal cilia basad of speculum a little sparser and slightly longer than distad, the speculum closed at posterior margin of wing by several rows of hairs but otherwise uninterrupted; marginal vein a little longer than broad, post-marginal distinct, about as long as stigmal.

Abdomen as long as head and thorax combined, as broad as thorax at base and tapering to a point at apex, distinctly reticulately sculptured over the whole dorsal surface, nearly smooth ventrally. Ovipositor exerted one-third the length of abdomen.

Male.—Length 0.85 mm. Like female except as follows: Whole antenna much paler in color, the scape whitish with a longitudinal fuscous stripe. pedicel and funicle grayish white, and club white; abdomen not longer than thorax, broadly rounded at apex, nearly circular, blackish dorsally but with lateral margins broadly margined with whitish.

Type locality.—Houma, La.

Type.—U. S. N. M. No. 57328.

Remarks.—Described from numerous specimens received from D. W. Clancy of the Charlottesville, Va., laboratory of the Bureau of Entomology and Plant Quarantine, where they were reared from *Pseudococcus boninsis* (Kuwana) collected at Houma, La., in November 1943. Besides this type series the following identifications of this species have been made by me: One specimen labeled as having been reared February 10, 1916, from *Pseudococcus calceolariae* (Maskell) [=misidentification of *P. boninsis* (Kuwana)] collected at Audubon Park, New Orleans, La., by E. R. Barber; three specimens reared in 1943 from *Pseudococcus boninsis* (Kuwana), collected at Houma and Raceland, La., by E. K. Bynum; two specimens indicated as having been reared from *P. boninsis* at Cairo, Ga., in 1932, by E. K. Bynum; two specimens taken at quarantine at Brownsville, Tex., on cut flowers from Mexico; nine specimens reared from the pink mealybug of sugarcane (*Trionymus sacchari* Cockerell), December 28, 1932, at Río Piedras, Puerto Rico, by F. Sein, under P. R. Acc. No. 178-32. Also before me are specimens reared in breeding tests at the Charlottesville, Va., laboratory from the following hosts: *Phenacoccus gossypii* Townsend and Cockerell, *Pseudococcus comstocki* (Kuwana), and *P. adonidum* (Linnaeus).

This species has become confused in the literature with *Aphyycus terryi* Fullaway (= *Pseudococcobius terryi* Fullaway). In the article by E. K. Bynum cited above, it is indicated that living material of *A. terryi* was received in 1932 by T. E. Holloway, of the Bureau of Entomology and Plant Quarantine laboratory in New Orleans, from the Hawaiian Sugar Planters' Experiment Station in Hawaii. The original stock was apparently increased by propagation in the labora-

tory, and during the same year releases are said to have been made on three sugarcane plantations in Louisiana; at Cairo, Ga.; at Belle Glade, Fla.; and a small shipment sent to G. N. Wolcott for release in Puerto Rico. Other releases of the parasite are said to have been made in 1933, 1934, and 1936 in several additional localities in the three states mentioned. According to Bynum the parasite was recovered in the field of introduction at Houma in 1932 and each year thereafter up to the time of publication. Recoveries were allegedly made at several other points of introduction including Cairo, Ga., and Belle Glade, Fla. At some points of introduction no recoveries were made. According to Wolcott attempts in Puerto Rico to recover *terryi* resulted only in the rearing from *Trionymus sacchari* of specimens which were identified by Muesebeck as a new species of the genus *Pseudaphycus*.

In 1943 I received from D. W. Clancy, of the Charlottesville, Va., laboratory, a series of specimens of a parasite reared from *Pseudococcus boninsis* that had been sent to him by J. W. Ingram, of the Bureau of Entomology and Plant Quarantine laboratory at Houma, La. These specimens had been reared from mealybugs collected in 1943 from fields in the vicinity of Houma and were supposed to be representatives of the introduced *Aphycus terryi*. They proved not to be *A. terryi*, however, but the above-described new species, *Pseudaphycus mundus*.

Following this discovery a request was made to the Houma laboratory for samples of the original shipment of parasites received from Hawaii for introduction into Louisiana. Such a sample was received and proved to be true *A. terryi*. Another lot labeled, "Cairo, Ga., 1932, ex *Pseudococcus boninsis* E. K. Bynum SC #333," and apparently constituting a part of the original release at that point, was also received. This sample proved to be not *terryi* but *Pseudaphycus mundus*. No representatives of the other releases were obtained, but specimens taken at Houma and Raceland, La., in 1943, supposedly representing recoveries of *terryi*, again turned out to be *P. mundus*. The specimens mentioned by Wolcott as having been taken in Puerto Rico and identified by Muesebeck as *Pseudaphycus* n. sp. were located in the National Museum collection and were also found to be the same as those from Louisiana and Georgia.

The above data show that the parasite received from Hawaii was certainly *Aphycus terryi* but that this species has not been recovered at any of those points of release from which material has been submitted for identification. All the alleged *terryi* reared from field collections at Houma that I have seen have been the new species *Pseudaphycus mundus*. Apparently also it was this species, not *terryi*, which was released at Cairo, Ga. Furthermore, it appears probable that this was

the species introduced into Puerto Rico and that this introduction was successful even though the species introduced was not the one intended.

Pseudaphycus mundus may be indigenous in Louisiana. As noted above it was reared at Audubon Park, New Orleans, as early as 1916, at least 16 years prior to the attempted introduction of *Aphycus terryi*. Circumstantial evidence would seem to indicate that in the attempt to increase the stock of the Hawaiian parasite in the laboratory, field-collected material of the host which had already been attacked by *P. mundus* was introduced into the cages and the two species thus became confused.

14. PSEUDAPHYCUS LIMATULUS, new species

The dorsum of the thorax in this species is more weakly sculptured, more distinctly shining, and of a darker yellowish-gray color than in any of the other species. Most closely resembles *graminicola* but distinguishable by the above characters and its slightly narrower frontovertex.

Female.—Length 0.75 mm. Frontovertex light orange-yellow; occiput slightly fuscous; eyes black; ocelli reddish; remainder of head whitish. Antennal scape and pedicel pale yellowish gray; funicle black or blackish; club mostly white, more or less stained with blackish basally. Mesoscutum, scutellum, and axillae yellowish gray; pronotum whitish, with its anterior face stained with blackish on each side of neck; propodeum dark brown; pleura, sterna, and all legs whitish; tegula whitish, its apex stained with fuscous; abdomen dorsally mostly dark brown or blackish, ventrally varying from mostly blackish to mostly whitish with only the middle blackish. Wings nearly uniformly faintly fuscous with faint indication of a paler transverse band beyond apex of venation. Ovipositor mostly dark brown, paler at base.

Frontovertex about two and one-half times as long as broad, mat, the sculpture made up of extremely minute alveolate punctures; inner orbits parallel for most of their length but diverging rapidly just above the scrobe; ocellar triangle nearly equilateral, or slightly acute; posterior ocellus about half its own diameter from eye margin and about its own diameter from occipital margin; anterior ocellus distinctly above middle of frontovertex; eyes with very short, inconspicuous pile. Antennae clavate; scape not expanded beneath; pedicel approximately one-third as long as scape and about as long as following four segments combined; funicular segments all broader than long, successively increasing in width from first to last, the fifth segment about twice as broad as long; club solid, distinctly broader than last funicular segment and only slightly shorter than funicle and pedicel combined.

Mesoscutum, axillae, and scutellum nearly flat, weakly sculptured, distinctly shining, and clothed with short pale pubescence; propodeum smooth and shining; mesopleuron weakly sculptured. Speculum of forewing partially interrupted near middle and closed at posterior margin of wing by one or two rows of cilia; discal ciliation moderately dense, very slightly coarser basad of speculum than distad of it; marginal vein punctiform, postmarginal short, stigmal about twice as long as marginal and postmarginal combined.

Abdomen ovate, very slightly longer than thorax and slightly narrower than thorax; tergites with distinct, shallow, reticulate sculpture, somewhat shining; sternites practically smooth and shining; ovipositor sheaths exerted approximately one-fifth the length of abdomen.

Male.—Length 0.65 mm. Similar to female but with frontoververtex only about twice as long as broad, mesoscutum along its anterior margin narrowly black, abdomen distinctly shorter and narrower than thorax and circular in outline.

Type locality.—Stevensville, Kent Island, Md.

Type.—U.S.N.M. No. 57329.

Remarks.—Described from 21 females (1 holotype) and 5 males (1 allotype) reared by H. S. McConnell, from *Phenacoccus* sp. found feeding on a species of *Andropogon* at Stevensville on Kent Island in Chesapeake Bay, August 3, 1942.

15. PSEUDAPHYCUS MERACUS, new species

This species is very similar to *meritorius*, new species, described elsewhere in this paper, and the two species are found infesting apparently the same species of mealybug in some localities in Virginia. It differs from *meritorius*, however, by having the segments of the funicle shorter and more transverse, by having the club somewhat longer than the entire funicle, and by having the anterior ocellus situated distinctly above the middle of frontoververtex.

Female.—Length 0.86 mm. Frontoververtex, mesoscutum, axillae, and scutellum orange with no dark markings; head except frontoververtex, tegulae, pronotum, pleura, sterni, and all legs whitish; metanotum and propodeum orange, a shade lighter than scutellum; abdomen dorsally mostly yellowish with a narrow blackish cross stripe connecting the cerci and basad of this stripe with one and apicad of it with two similar but less distinct fuscous stripes; abdomen beneath slightly paler; ovipositor pale at base, darker apically; eyes grayish black, ocelli dark red; antennal scape nearly uniformly pale yellowish, pedicel and funicle fuscous, the apical funicular segments usually paler than the basal ones; club white. Wings uniformly subhyaline; marginal and stigmal veins fuscous. Hairs on mesonotum whitish.

Frontoververtex somewhat more than twice as long as broad, finely granulose but under high magnification with faint indications of

alveolate sculpturing; inner orbits parallel for most of their length; ocelli forming a slightly acute triangle; anterior ocellus about one and a half times the width of frontovertex above the edge of scrobal cavity; lateral ocellus less than its own diameter from eye margin and more than its diameter from occipital margin; eyes with distinct short pile. Antenna clavate; scape not expanded beneath, slightly broader at middle than at either end, four times as long as broad; pedicel about one-third as long as scape, very nearly as long as first four funicular segments combined; funicular segments all broader than long, successively increasing in thickness from first to last, the basal segments distinctly narrower than pedicel, last segment about as broad as pedicel; club large, broader than last funicular segment and a little longer than entire funicle.

Mesoscutum, axillae, and scutellum uniformly granulosely punctate, mat; propodeum smooth; mesopleuron distinctly finely reticulate-punctate, subopaque. Forewing with rather dense discal ciliation, the cilia basad of speculum a little coarser than those beyond; speculum closed posteriorly by one or two rows of hairs, otherwise uninterrupted; marginal vein punctiform; stigmal vein a little longer than postmarginal.

Abdomen short ovate, slightly narrower and a little shorter than thorax, very weakly reticulated and shining dorsally, and practically smooth ventrally. Ovipositor exerted about one-fourth the length of abdomen.

Male.—Length 0.75 mm. Similar in practically every respect to the female except that the abdomen is nearly circular in outline, obviously shorter and narrower than the thorax and blackish medially with the margins broadly yellowish.

Type locality.—Hamilton, Va.

Type.—U.S.N.M. No. 57330.

Remarks.—Holotype female, allotype, and 13 paratypes reared July 5, 1943, from *Pseudococcus virgatus* (Cockerell), collected at Hamilton, Va., and received from D. W. Clancy of the Charlottesville, Va., laboratory under No. 528; also 35 paratypes reared May 16, 1944, from the same host collected at Batesville, Va., under Clancy's No. 611. Many additional specimens reared by Clancy from *P. virgatus* collected at Hamilton, Batesville, Crozet, Winchester, Greenwood, and Covesville, Va., are in the collection identified as this species but not considered a part of the type series.

16. PSEUDAPHYCUS ALVEOLATIFRONS, new species

Differs from all other forms studied in the coarser and much more distinct alveolate sculpture and paler orange-yellow color of the frontovertex.

Female.—Length 0.82 mm. Frontoververtex very dilute orange yellow, its entire surface uniformly densely covered with fine but perfectly distinct facetlike punctures. In all other respects apparently agreeing with the foregoing description of *meracus* so that the description of that species except for the frontoververtex will serve for this species also.

Male.—The head is gone from the single male specimen received so that the characters of the head are unknown. With respect to the other characters this male seems to differ in no significant respect from the male of *meracus*.

Type locality.—North Bergen, N. J.

Type.—U.S.N.M. No. 57331.

Remarks.—Described from a unique female and one headless male reared in November 1938 by George Rau from *Pseudococcus comstocki* (Kuwana).

The frontoververtex in most of the forms studied is granulosely sculptured and mat, with little or no indication of distinct separate alveoli or punctures even under the higher magnifications of a binocular microscope. In *angelicus*, *abstrusus*, *meracus*, and *limatulus* the sculpture of frontoververtex is more or less distinctly alveolate but the alveoli are finer and less definite. *P. alveolatifrons* differs from *angelicus* and *abstrusus* further by having the ocelli in an equilateral, instead of a distinctly acute, triangle and by lacking the transverse hyaline streak on the wing. From *limatulus* it may be distinguished by the distinctly duller sculpturing of the mesonotum as well as by its brighter orange-yellow color.

It is possible that additional material may show that the differences between *meracus* and *alveolatifrons* are not of specific value, but in view of the fact that the types of the two species are from different hosts and from different localities and this sculptural difference does exist, it seems wisest to give a separate name to this form from *P. comstocki* even though it may eventually turn out to be a synonym.