

PHOTO RECOGNITION KEY TO THE WHITEFLIES AND SCALE INSECT FAMILIES OF CALIFORNIA

By Raymond J. Gill

WHITEFLIES

Small insects in the order Homoptera, family Aleyrodidae which feed on plants by removing plant sap. Injury can be caused to plants by this feeding and by the secretion of honeydew by the whitefly which supports the growth of unsightly sooty-mold fungi. See Scale Key #2 (printed separately) for a field key to the California species.

SCALE INSECTS

Small insects in the order Homoptera, superfamily Coccoidea which feed on plants by removing plant sap. Injury can be caused to plants by this feeding and in most cases by the secretion of honeydew which supports the growth of unsightly sooty-mold fungi. There are 15 scale insect families in California.

HOW TO USE THIS KEY

(A pocket magnifier of 5 to 20x magnification may be useful):

1. After locating the specimens on the host, try to locate all of the various stages present and try to determine if more than one type of organism is present.
2. Starting at the upper left corner of the key, compare the specimens with the captions and photos. There are two choices. Pick the most correct choice and follow the line to the next set of captions and photos.
3. Check each subsequent choice carefully. There are at least two choices but there may be more. Make sure that each line is followed to all arrows and captions.
4. Continue until your specimens match the captions and photo of a particular family.
5. If your specimens belong in the families Aleyrodidae, Pseudococcidae, Coccidae or Diaspididae, consult the photo keys to the California species published separately.

CAUTION

1. In the field, many of the whiteflies and scale families are very similar in appearance. This key has been designed to reduce this problem but to eliminate it entirely is impossible.
2. There are a number of insects in other families, as well as a number of other objects and organisms which can be confused with scale insects and whiteflies.
3. The immature stages of whiteflies and scale insects often do not look like the adult stages.
4. Positive identification of whiteflies and scale insects require complex laboratory procedures and they should be made by a qualified taxonomist.

FIELD DETERMINATIONS USING THIS KEY SHOULD BE CONSIDERED TENTATIVE. THE POSSIBILITY EXISTS THAT YOU MAY HAVE FOUND A SPECIES NEW TO CALIFORNIA. PLEASE HELP PREVENT A NEW PEST OUTBREAK BY SUBMITTING SPECIMENS TO THE OFFICE OF YOUR COUNTY AGRICULTURAL COMMISSIONER.

Acknowledgements

Thanks are due to the county entomologists, other county personnel and the state exclusion specialists who supplied most of the samples from which the photos were taken. Robin Breckenridge assisted with the manuscript and initial layout. Charles and Marge Papp provided the technical assistance needed for layout and printing. Robert Dowell and Lyndon Hawkins provided the purpose and the funds which made this project possible. Special thanks are due to Lyndon Hawkins, Kirby Brown and Ray Bingham who originated and developed the photo-key concepts.

ADDITIONAL INFORMATION

WHITEFLIES — FAMILY ALEYRODIDAE Fig. 1-4. Adults are small, gnat-like flying insects usually coated with powdery white wax. Immature forms are restricted to the lower leaf surfaces and occasionally the upper leaf surfaces of the host. About 60 species occur in California and some are serious economic pests. See Scale Key #2 (printed separately) for keys to the more important California species.

MARGARODID SCALES — FAMILY MARGARODIDAE Fig. 10, 11, 18. Scales in this family are variable in appearance and are difficult to characterize in a pictorial key. There are 18 species presently known from California. Two of the well known economic forms are illustrated here. Most species in California are non-economic except for several species which attack conifers.

ENSIGN SCALES — FAMILY ORTHEZIIDAE Fig. 19. These scales are characterized by their dorsal wax plates and long, plated ovisacs. Approximately 8 species are known from California. Only one species, greenhouse orthezia, is a minor pest, usually on ornamental plants.

LAC SCALES — FAMILY KERRIIDAE Fig. 26. These scales are characterized by their dark reddish color, irregular shape and glassy covering. Asian members of this family are used as a source of shellac. California species could be used to produce shellac but it is not commercially feasible to do so. Four species are known from native desert shrubs in Southern California.

OAK GALL SCALES — FAMILY KERMESIDAE Fig. 8. Also known as the family Kermidae, these scales are so named because they resemble the galls which are commonly formed on oaks by cynipid wasps. About 12 non-economic species are found on oak and chinquapin in California.

WOOLLY SAC SCALES — FAMILY ERIOCOCCIDAE Fig. 16, 17. About 40 species of woolly sac scales occur in California. Most resemble mealybugs in shape but usually have reddish bodies and lack the mealy wax. See Scale Key #3 (printed separately) for further help in separating this family from the mealybugs. Several species including European elm scale and cactus spine scale are of economic concern in California.

COCHINEAL SCALES — FAMILY DACTYLOPIIDAE Fig. 27. A member of this family of scales is the source for the crimson dye called cochineal. California species are crimson in color (surrounded by white wax) but do not produce quality cochineal. Three species occur in California and one of these species has been used as a control for unwanted prickly pear cactus.

PIT SCALES — FAMILY ASTEROLECANIIDAE Fig. 13, 14. Some members of this family cause the formation of pits on the twigs of the host. There are 9 species in California and several are economic pests. One species, oak pit scale, is a serious pest of oak trees. Most members of this family resemble whiteflies but the pit scales are not restricted to the leaves as the whiteflies are.

FALSE PIT SCALES — FAMILY LECANODIASPIDIDAE Fig. 12. There are 3 California species, all on desert shrubs in Southern California. They are characterized by the tapered, parchment like appearance of the scale cover. Only one species is common.

CEROCOCCINS — FAMILY CEROCOCCIDAE Fig. 9. Only 1 species, oak wax scale, occurs in California. It occurs only on scrub oak species in the desert areas of Southern California. It is non-economic, but it was eaten like chewing gum by the California Indians.

BUNCH GRASS SCALES — FAMILY ACLERDIDAE Fig. 30. One species is currently known from various native perennial grasses in California. An introduced species which resembles noxious bamboo mealybug has been collected several times on bamboo in California. As far as is known, these scales are non-economic.

MEALYBUGS — FAMILIES PSEUDOCOCCIDAE and PUTOIDAE Fig. 15, 21. Most members of these families are covered with mealy white wax. Many are serious plant pests. The Pseudococcidae is the largest scale insect family in California, containing about 180 species, most of which are probably native. See Scale Key #3 (printed separately) for a field key to the more important California species. About 20 species of mealybugs in the genus *Puto* are now considered as part of the insect family Putoidae by most mealybug taxonomists. These native species are generally larger than regular mealybugs and they are covered with thick, ornate tufts of white wax.

SOFT SCALES — FAMILY COCCIDAE Fig. 22-25. This family is best recognized by the hemispherical or tortoise shell appearance which many of the species have. About 45 species occur in California and many are serious plant pests. See Scale Key #4 (printed separately) for a field key to most of the California species.

PALM SCALES — FAMILY PHOENICOCOCCIDAE Fig. 29. This is a small family and there is only one species, red date scale, known from California. Red date scale is a minor pest in commercial date orchards in Southern California. It can be found in other areas of the state on ornamental palms.

ARMORED SCALES — FAMILY DIASPIDIDAE Fig. 5-7. Armored scales are easily recognized by the distinctive scale covers which contain the exuviae (cast skins) of the earlier instars. The exuviae usually have colors which contrast with the rest of the scale cover. Armored scales are probably the most injurious of all the scale insects. However, unlike most other scale insect families, armored scales do not produce honeydew. There are about 140 species known from California. See Scale Key #5 (printed separately) for a field key to the more important California species.

START HERE

tiny, white, gnat-like flying insects present, usually on lower leaf surfaces:
Adult Whiteflies
ALEYRODIDAE



1

tiny, white, flying insects not present

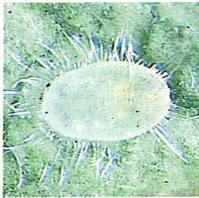
specimens usually less than 2½mm in length or diameter, Immobile

specimens usually more than 2½mm in length or diameter, may be mobile

normally on lower leaf surfaces only; small (usually less than 1.5mm long), tan, transparent-yellowish or jet-black, often adorned with flower-like wax patterns:
Immature Whiteflies
ALEYRODIDAE



2



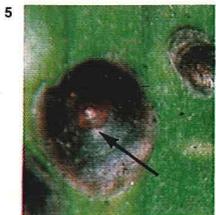
3



4

small specimens, less than 2½mm in size; either circular or similar to oyster shells or mussel shells in shape; usually with exuviae (cast skins) incorporated into the scale cover:

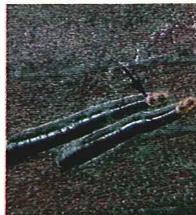
Armored Scales
DIASPIDIDAE



5



6



7

not restricted to lower leaf surfaces

egg-like or thrips-like; associated with necrotic spots under leaves and cottony masses under bark of sycamore:
Sycamore Scale
MARGARODIDAE



10



11

Fig. #11 shows close up of leaf

not restricted to twigs of oak

specimens nearly spherical: on twigs of oak

usually tan in color, never bright yellow; never with a gum-like cover; on oaks throughout California:
Oak Gall Scales
KERMESIDAE



8

bright yellow; often crowded closely together; with a gum-like cover or test; on scrub oak in the desert areas of Southern California:
Oak Wax Scale
CEROCOCCIDAE



9

adults covered by a tan, tapered, parchment-like ovisac; lateral wax buttons absent, but ventral white spiracular furrows often present

young specimens brown; resembling soft scales; on native shrubs in arid areas only
False Pit Scales
LECANODIASPIDIDAE



12

usually on twigs; with flower-like or spiny wax patterns; may cause pits or other distortions on twigs
Pit Scales
ASTEROLECANIIDAE



13



14

body color yellow, grey, brown or black

body color pink, red or purple

usually not covered with white wax, if so, then specimens very flat in profile, on twigs, immobile

covered with white wax; often cylindrical, mobile

nymphs and young adults tapered posteriorly; with waxen spines, particularly on margin, older females completely enclosed in a tapered, snow-white ovisac

body color red; legs and antennae black; large, white, grooved ovisac present in adult stages; nymphs red with yellow wax

covered with mealy white wax
Mealybugs
PSEUDOCOCCIDAE
PUTOIDAE

Woolly Sac Scales
ERIOCOCCIDAE

Cottony Cushion Scale
MARGARODIDAE



covered with white wax plates; also with a moveable, plated ovisac
Ensign Scales
ORTHEZIIDAE

body pink or reddish-brown (not crimson); globular; on many hosts; several similar families — see the field key for mealybugs

body dark-purple, body wax yellow, ovisac poorly formed, on *Araucaria*.
Golden Mealybug
PSEUDOCOCCIDAE



without a tapered, parchment-like ovisac, with two white wax buttons on each side, usually visible on all but the very convex individuals; white spiracular furrows evident if specimens are turned over, quite variable in shape depending on age and host

Soft Scales
COCCIDAE



Fig. #23 shows ventral view

Irregularly spherical; body deep reddish-brown; covered by a resinous red test; often very gregarious; on native shrubs in Southern California
Lac Scales
KERRIIDAE

body crimson red; often surrounded by white wax; on cactus *only*
Cochineal Scales
DACTYLOPIIDAE



strongly hemispherical to nearly spherical, often mottled with red, black and other colors, particularly in spring. May be soft scales (COCCIDAE). See field key for soft scales

on palms *only*; globular; reddish-brown; surrounded by white wax
Palm Scales
PHOENICOCCOCCIDAE

elongate; pink or reddish-brown with white wax; between leaf sheaths of native grasses or on bamboo
Bunch Grass Scales
ACLERIDAE
(see also mealybugs)

