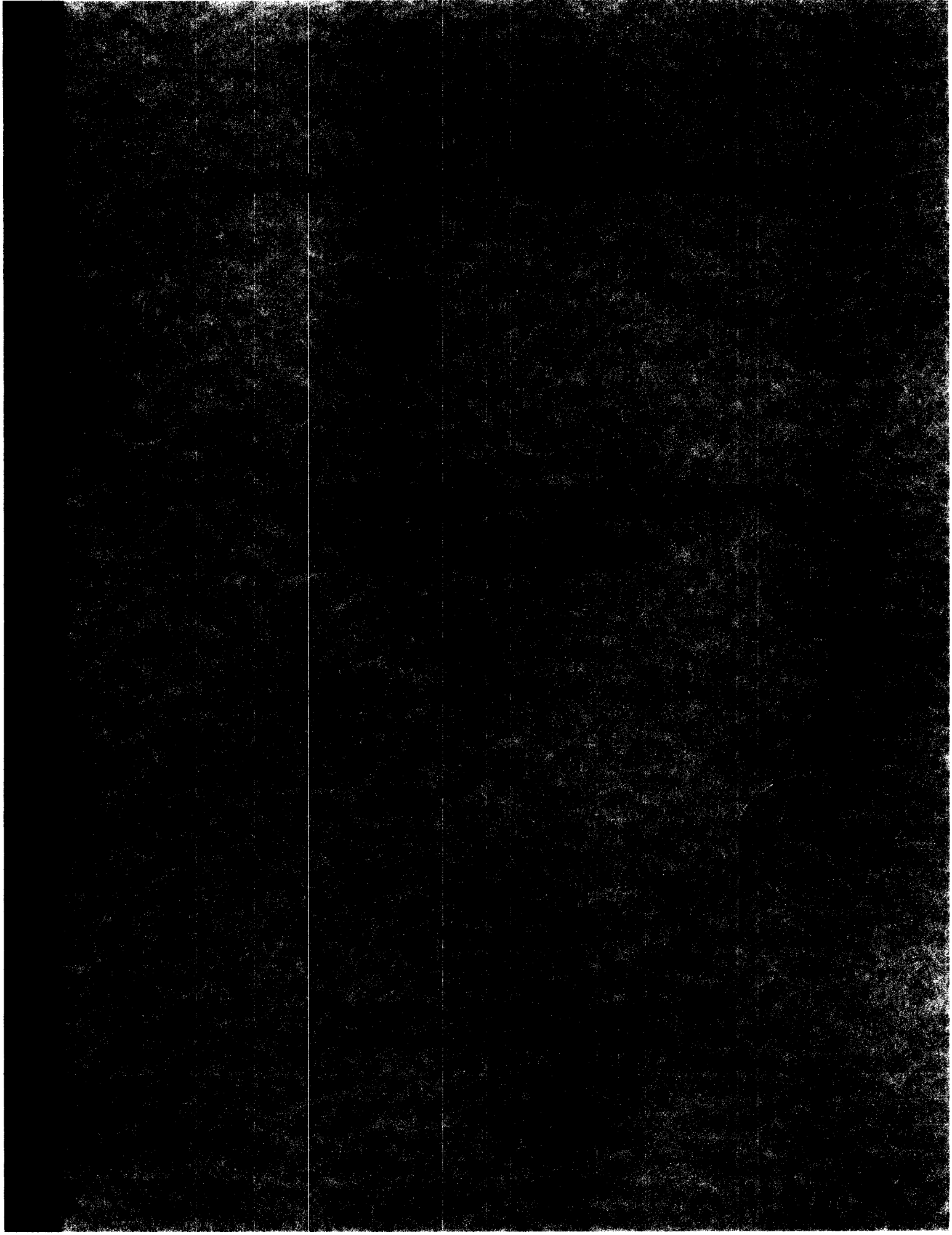

Map of California, showing county boundaries.

BULLETIN OF THE CALIFORNIA INSECT SURVEY

VOLUME 5

THE ARMORED SCALE INSECTS OF CALIFORNIA

BY

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(State of California Department of Agriculture, Bureau of Entomology)

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LIST OF COLORED PHOTOGRAPHS

Many of the specimens used to produce the accompanying colored photographs were collected by various individuals at my request. For those who participated in this project acknowledgments are here made.

With the exception of the colored photograph of Hall scale, *Nilotaspis halli* (Green) which has been enlarged three diameters (×3), the remainder have been photographed actual size on the infested plant part. It is hoped these colored photographs will help in identifying a few of our more common California diaspidids as they are seen in the field.

Plate 1 and the top row of plate 2 include those diaspidids belonging to the tribe Aspidiotini; the remainder are referable to the tribe Diaspidini. The species have not been arranged chronologically under each tribe, but instead are assembled more for the purpose of eye appeal and beauty.

The following list includes specific collection data for each photograph:

PLATE 1

Aonidiella aurantii (Maskell), Pomona, Los Angeles Co., December 26, 1953, on *Citrus limon* (lemon) (H. L. McKenzie).

Aonidiella citrina (Coquillett), Reedley Area, Fresno Co., January, 1954, on *Citrus sinensis* (orange) (T. E. Corn).

Aspidiotus hederae (Vallot), Sacramento, November, 1953, on *Hedera helix* (ivy) (R. Z. Rollins).

Chrysomphalus bifasciculatus Ferris, Sacramento, November, 1953, on *Hedera helix* (ivy) (R. Z. Rollins).

Diaspidiotus ancylus (Putnam), Hemet, Riverside Co., June 28, 1954, on *Prunus armeniaca* (apricot) (H. L. McKenzie).

Hemiberlesia degenerata (Leonardi), Sanger, Fresno Co., May 13, 1954, on *Camellia* sp. (J. C. Bedford).

Hemiberlesia lataniae (Signoret), Orange Co., May 30, 1954, on *Persea* sp. (avocado) (D. Bishop).

Lindingaspis rossi (Maskell), Montecito, Santa Barbara Co., December 6, 1954, on *Sequoia sempervirens* (redwood) and *Araucaria* sp. (W. S. Cummings).

Nuculaspis californica (Coleman), Lake Gregory, San Bernardino Co., March 9, 1954, on *Pinus ponderosa* (yellow pine) (G. L. Downing).

PLATE 2

Aonidomytilus ceanothi Ferris, Larson Valley, El Dorado Co., December 27, 1954, on *Ceanothus integerrimus* (L. Mobley).

Aulacaspis rosae (Bouché), Sacramento, May 28, 1954, on *Rubus* sp. (mammoth blackberry) (H. H. Keifer).

Carulaspis visci (Schrank), Sacramento, May 26, 1954, on *Juniperus* sp. (juniper) (H. L. McKenzie).

Diaspis bromeliae (Kerner), San Diego, February 23, 1954, on Bromeliad (G. Hill and R. J. Buckner).

Diaspis echinocacti (Bouché), Norco, Riverside Co., June 28, 1954, on *Opuntia hamiltoniae* (cactus) (R. M. Hawthorne and H. L. McKenzie).

Diaspis manzanitae (Whitney), Magalia, Butte Co., October 30, 1939, on *Arctostaphylos* sp. (manzanita) (H. H. Keifer).

Quadraspidiotus juglans-regiae (Comstock), Greenspot, San Bernardino Co., June 27, 1955, on *Juglans* sp. (walnut) (G. M. Harper).

Quadraspidiotus perniciosus (Comstock), San Leandro, Alameda Co., May 26, 1954, on *Prunus* sp. (plum) (E. K. Strobridge).

Selenaspidus albus McKenzie, Norco, Riverside Co., June 28, 1954, on *Euphorbia submammillaris* (succulent) (R. M. Hawthorne and H. L. McKenzie).

PLATE 3

Chionaspis salicis-nigrae (Walsh), Alturas, Modoc Co., August 6, 1936, on *Cornus* sp. (dogwood).

Lepidosaphes beckii (Newman), Santa Barbara, December 16, 1954, on *Citrus sinensis* (orange) (W. S. Cummings).

Lepidosaphes ulmi (Linnaeus), Sacramento, November 5, 1953, on *Salix* sp. (willow) (H. H. Keifer).

Nilotaspis halli (Green), Chico, Butte Co., May 10, 1950, on *Prunus amygdalus* (almond) (E. F. Fosen).

Parlatoria camelliae (Comstock), Hickman, Stanislaus Co., February, 1954, on *Camellia* sp.

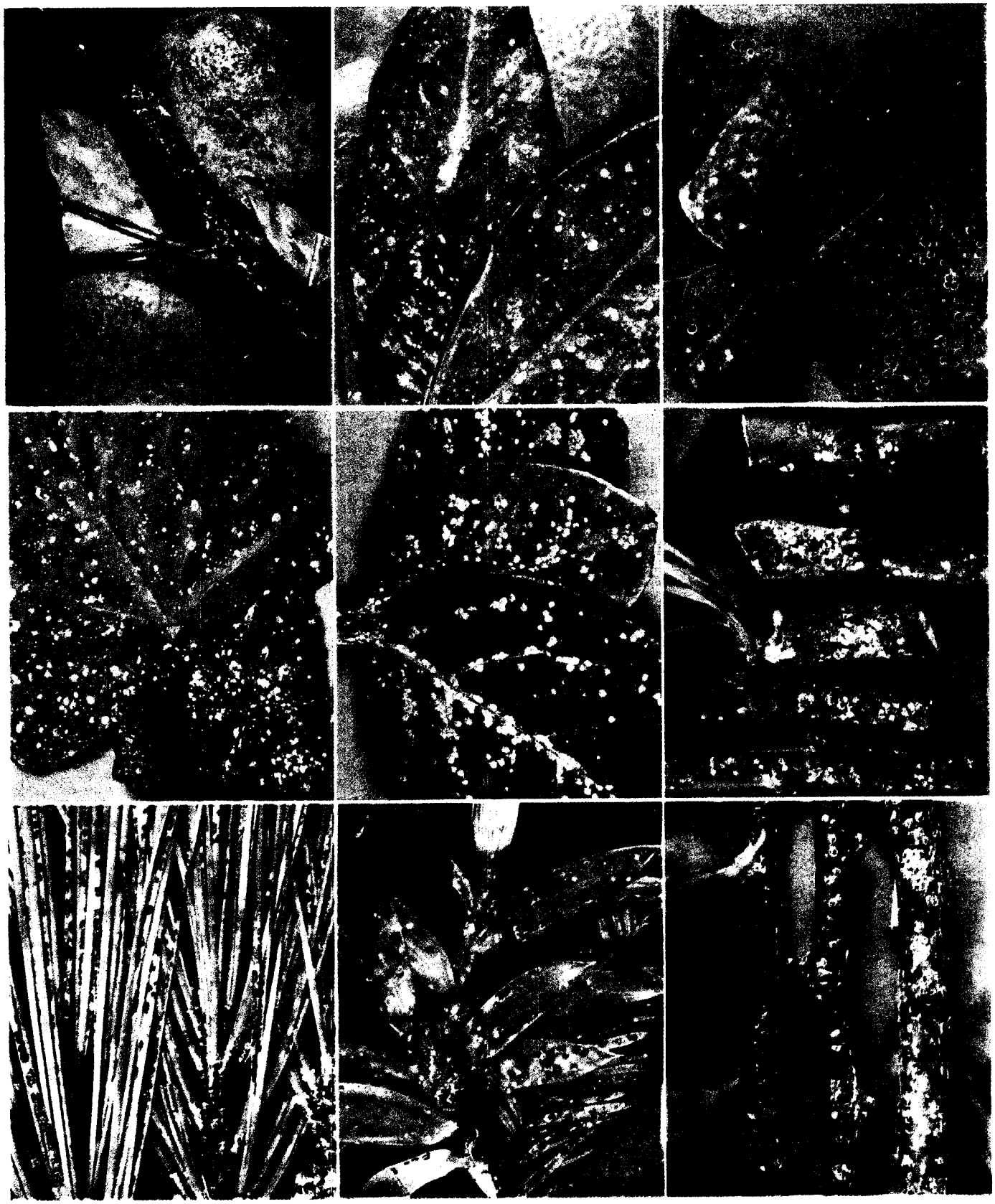
Parlatoria oleae (Colvée), Madera Co., January 7, 1954, on *Olea europaea* (olive) (T. B. Gallion).

Parlatoria pittospori Maskell, San Diego, December 9, 1954, on *Pittosporum* sp. (R. F. Wilkey).

Phenacaspis pinifoliae (Fitch), Crestline, San Bernardino Co., March 9, 1954, on *Pinus ponderosa* (yellow pine) (C. L. Downing).

Unaspis euonymi (Comstock), Sacramento, November 4, 1954, on *Euonymus* sp. (H. L. McKenzie).

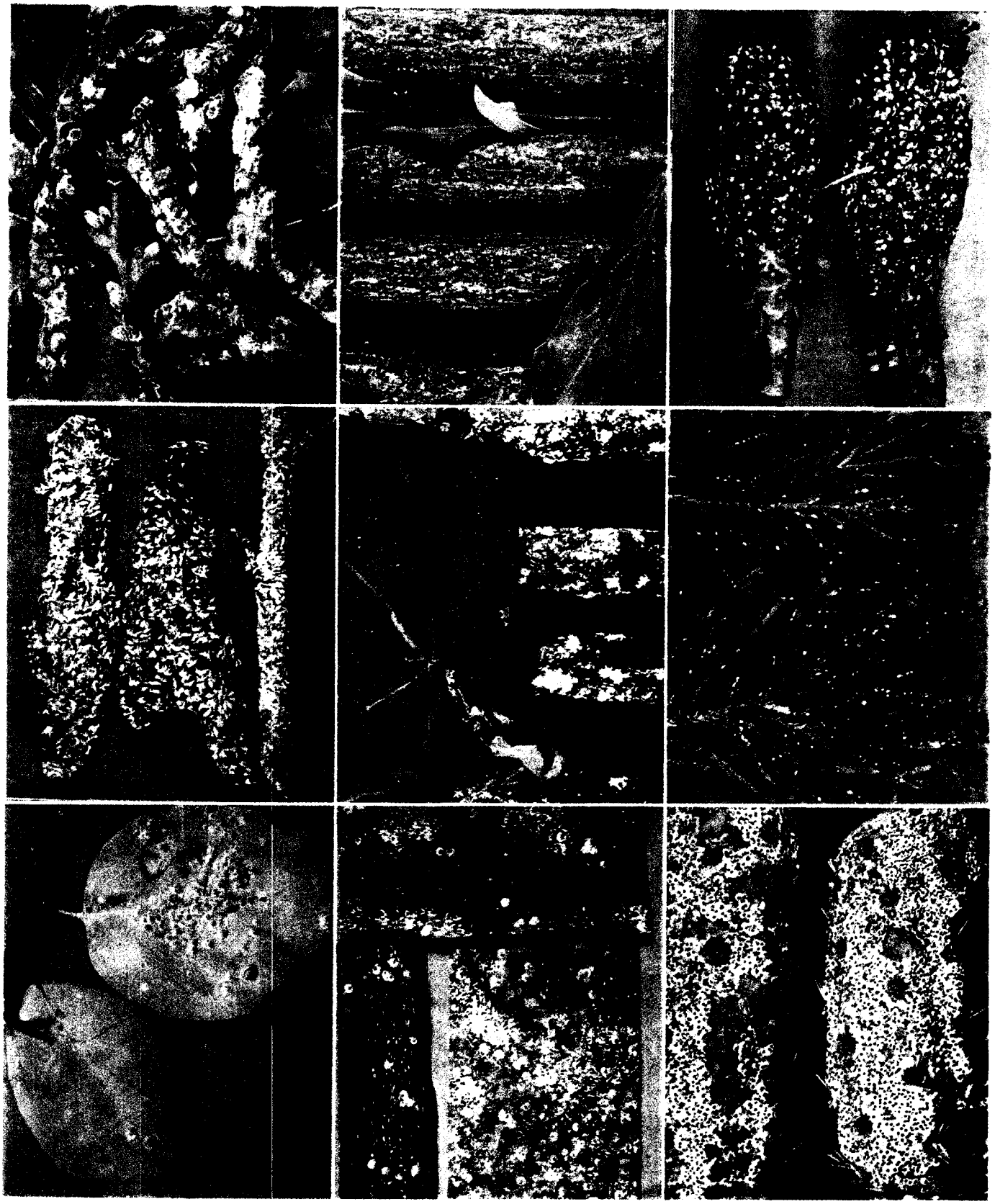
PLATE 1



Top row. Left: *Aonidiella aurantii* (Maskell), California red scale; center: *Aonidiella citrina* (Coquillett), yellow scale; right: *Chrysomphalus bifasciculatus* Ferris, Bifasciculate scale.

Middle row. Left: *Aspidiotus hederae* (Vallot), ivy scale; center: *Hemiberlesia degenerata* (Leonardi), degenerate scale; right: *Hemiberlesia lataniae* (Signoret), Latania scale.

Bottom row. Left: *Nuculaspis californica* (Coleman), black pine leaf scale; center: *Lindingaspis rossi* (Maskell), black araucaria scale; right: *Diaspidiotus ancylus* (Putnam), Putnam scale.



Top row. Left: *Quadraspidiotus juglans-regiae* (Comstock), walnut scale; center: *Quadraspidiotus perniciosus* (Comstock), San Jose scale; right: *Selenaspidus albus* McKenzie, white euphorbia scale.

Middle row. Left: *Aonidomytilus ceanothi* (Ferris), Ceanothus scale; center: *Aulacaspis rosae* (Bouché), rose scale; right: *Carulaspis visci* (Schrank), juniper scale.

Bottom row. Left: *Diaspis manzanitae* (Whitney), manzanita scale; center: *Diaspis bromeliae* (Kerner), pineapple scale; right: *Diaspis echinocacti* (Bouché), cactus scale.

PLATE 3

Top row. Left: *Chionaspis salicis-nigrae* (Walsh), black willow scale; center: *Nilotaspis halli* (Green), Hall scale (enlargement ×3); right: *Lepidosaphes beckii* (Newman), purple scale.

Middle row. Left: *Parlatoria camelliae* Comstock, camellia parlatoria scale; center: *Lepidosaphes ulmi* (Linnaeus), oystershell scale; right: *Parlatoria oleae* (Colvée), olive parlatoria scale.

Bottom row. Left: *Parlatoria pittospori* Maskell, Pittosporum diaspidid; center: *Phenacaspis pinifoliae* (Fitch), pine needle scale; right: *Unaspis euonymi* (Comstock), Euonymus scale.

CONTENTS

EXPLANATION OF ABBREVIATIONS IN FIGURES

Except for the first three figures which are purely morphological and which are explained independently, a standard system of labeling the illustrations has been employed. This system of labeling will be as follows:

A. Antenna and cephalic margin of first stage.
B. Habitat sketch.
C. Antenna of adult female.
D. Anterior spiracle of adult female. The anterior spiracle has been chosen for illustration because significant differences, such as pore arrangement, occur with these rather than in the posterior pair.
E. Pygidium of second-stage female.
EE. General outline of second stage in those forms which are pupillarial.
F. General features of adult female.
G. Pygidium of adult female.
H. Dorsal aspect of detail of pygidial margin of adult female.
I. Ventral aspect of detail of pygidial margin of adult female.
J. Outline of exuvium of first stage in a few forms.

Unlettered figures of details are connected with their points of origin by guide lines and should be readily identifiable.

INTRODUCTION

One of the groups of insects most important to the agriculturalist today is that family including the creatures popularly known as the "armored scales" or "diaspidids." This study deals specifically with the scale insects belonging to the homopterous family Diaspididae. Unfortunately, they are very unattractive to the average entomologist, and even more so to the agriculturalist; yet a knowledge of each species, together with the best methods of control, is an essential part of the education of every fruit grower. Furthermore, there is scarcely any tree or shrub that is not subject to their attack. The minute size of these creatures, their wonderful reproductive powers, and the difficulty of destroying them, all unite to place them among the most formidable pests of the orchard, grove, nursery, or field in which they have gained a foothold. It should be remembered that each scale insect, after having settled on the trunk, branch, stem, or leaf of the host plant, essentially turns itself into an automatic pump extracting the sap so vital to the life and growth of the tree.

Injury to the plant tissue is often aggravated by toxic enzymes in the saliva of certain of these species. These enzymes are sometimes responsible for chlorophyll removal and discoloration of leaves as well as malformation and other growth irregularities of plant tissue. Since many of our fruit growers are without knowledge of armored scale insects, damage is usually done before the infestation is discovered. The attacked tree or shrub will put forth every effort to sustain itself against the attack of the scale insect and will not, at first, show any immediate damage. Ultimately, however, even the strongest tree will yield to the persistent pumping of its sap by the feeding individuals, and will show evidences of leaf, twig, and branch killing or will suddenly collapse and die. To establish this fact, it is only necessary to cite the activities of California red scale, *Aonidiella aurantii* (Maskell), so destructive to citrus in California.

Some species are restricted to a single host, others to a single genus or family of host species, but many are extremely omnivorous and infest many plants of unrelated groups. The diaspidids are generally distributed throughout the world wherever suitable food plants are grown. It has been proven, that though many genera are native to certain regions they have been distributed in commerce to other parts of the world.

Carnes (1907) presented a treatise, *The Coccidae of California,* in which he included thirty-two diaspidid scales established in this state. At this writing (1955) some forty-nine years later, the number of established species of this family stands at one hundred and thirty-two, an increase of one hundred species. This is largely owing to the activities of Professor G. F. Ferris, who, in 1937-1942, described and clarified the status of many of our California diaspidids in his monumental treatment the *Atlas of the Scale Insects of North America.*

ACKNOWLEDGMENTS

This study on the armored scales of California has been prepared on invitation of the University of California, Department of Entomology and Parasitology, as a contribution to the California Insect Survey series. My position as taxonomist in the California Department of Agriculture has given me access to a tremendous amount of material, submitted from various sources for identification. Furthermore, this Department has maintained extensive and accurate collection records of diaspidids taken in this state, and these data have

been extensively used in this publication. As a matter of fact, without this information a solution of the problem would have been grossly incomplete, obviously resulting in a distorted picture of the California diaspidid fauna. The State Department of Agriculture has very generously permitted the diversion of considerable time from my regular duties for preparation of this study.

Distribution and host records have been made available from diaspidid scale collections of the Natural History Museum at Stanford University, and the United States Department of Agriculture, Agricultural Research Service, Crops Research, Entomology Research Branch, Insect Identification Section at Washington, D.C. The scientific libraries of the University of California, Stanford University, and the California Department of Agriculture were consulted during the preparation of this study.

Acknowledgments are made to Professors R. L. Usinger and E. Gorton Linsley, both of the University of California, Department of Entomology and Parasitology, Berkeley, who asked me to undertake this project.

Bureau of Entomology personnel of the California State Department of Agriculture, including H. M. Armitage, Chief, and R. W. Harper, Assistant Chief, have been aware of this project and have offered advice and encouragement during its preparation. Hartford H. Keifer, Supervisor in Charge Taxonomy Office, has aided in many ways, particularly in constructive ideas relative to arrangement of the indices.

Professor G. F. Ferris, Coccidologist of Stanford University, assisted me in straightening out certain complexities in taxonomic literature pertaining to certain species. He also generously loaned his excellent diaspidid scale pen and ink illustrations (originals) which are used together with those prepared by me. Appreciation is expressed to Professor Ferris and to Stanford University Press for granting permission to use these illustrations and certain sections of the text from the *Atlas of the Scale Insects of North America.*

Dr. A. M. Boyce, Director of the University of California Citrus Experiment Station at Riverside, made a direct and successful effort to justify the printing of the colored plates of certain California diaspidids incorporated in this publication. A sincere appreciation of his effort is here expressed.

De Witt Bishop of the California State Department of Agriculture, Bureau of Chemistry, gave specific instructions necessary to produce the colored photographs of the various diaspidids. To him I am grateful, and I here acknowledge his kind assistance.

SCOPE OF STUDY

Among the wide range of species of the armored scales are many which are primary pests of major agricultural crops in California. Knowledge of the complex taxonomy of the entire group is necessary to identify accurately the thousands of specimens received annually in the Sacramento office of the State Department of Agriculture and to record their occurrence within the state and evaluate their economic importance.

The present study includes treatment of all known diaspidid scale insects found in California. A dichotomous key to genera and species is presented to aid the identifier. Pertinent taxonomic literature chronologically arranged, type locality and host, other known hosts, and specific localities in various California counties, together with the date collected and the collector, are included herein. Whenever possible the present status of each species is indicated under the "Discussion" paragraph, and its relationship to allied species is implied. Only selected taxonomic references are included for each species.

An index to genera, species, and higher categories of California Diaspididae, a host index, and finally a host list including the Diaspididae species arranged alphabetically by plant families are incorporated herein to aid the reader in locating desired information. With the exception of the omnivorous species (p. 173) an attempt has been made to record every known host for each form. A detailed drawing of each species is presented and should be used in identifying the form. Colored photographs of some of the armored scale species have been included. It is hoped that these illustrations which have been taken actual size *in situ* on the host, will enable field workers to recognize our more important diaspidids.

DESCRIPTION AND GENERAL BIOLOGY

In an armored scale or diaspidid, a protective covering of wax is excreted from tubular ducts situated at the posterior region of the body (pygidium). This wax forms two protective scales; the one above the body of the diaspidid is usually very hard and brittle and the one beneath, lying close to the surface of the plant where the insect is feeding, is thin and delicate. The body of the adult female lies between these two scale layers. Thus, if the top covering is carefully removed with a needle or thin knife blade, the adult female

diaspidid may be observed beneath, like a tiny clam between two shells.

Armored scale insects vary markedly in shape; some species being circular to subcircular, oval, elongated, linear, threadlike, oyster shell-shaped, or fluted. The surface may be flat, convex, cone-shaped, smooth or ridged, thin and delicate. They are variously colored from white to gray, yellow and various shades of brown, dull red, or black. Diaspidids range in size from less than 1 mm. to more than 3 mm. in diameter.

The young of armored scale insects are either born alive (viviparous) or hatched from eggs (oviparous), and are the only motile forms except the adult male of this large group. The eggs are laid beneath the scales, and after the adult female dies the scale covering provides protection. The eggs are generally bean-shaped and are scarcely visible to the naked eye. They are variously colored, ranging from white to yellow, reddish to purple.

The young crawlers are oval-shaped and very minute, with distinctly segmented body, two long anal filaments, and usually, six-segmented antennae. They possess a pair of ocelli, three pairs of segmented legs with two pairs of digitules at the ends of the tarsi, a one-segmented rostrum or beak, and a posterior anus. Aside from their own powers of locomotion they may be distributed by birds, insects, and possibly by wind. They move about for a time and finally select a favorable location on the food plant where they insert their beaks and commence feeding. If a suitable feeding place is not found within a few hours the crawlers may perish. Their habit of settling beneath and around the adult female scale often results in the formation of compact colonies which may become encrusted on the host plant where they are feeding. Very little if any honeydew is excreted by armored scale insects, and usually the scale covering is perfectly dry.

Soon after settling, fine threads of wax, which appear cottony, begin to exude from the body of the crawler, and this waxy excretion continues until the insect is completely covered. The rate at which this excretion is produced varies according to the individual species. In due time the crawler begins to excrete a pellicle, which is very thin but dense and firm in texture. In certain Aspidiotine species the cottony fibers remain as a central white dot or ring, hence the common name "white cap."

The first molt soon follows, resulting in a retrogression instead of an advancement to a more highly specialized form, with the loss of legs, segmented antennae, and anal filaments. As a consequence the second-stage nymph assumes a stationary position. The mouth parts or stylets, however, remain in a highly developed condition well fitted to perform their functions. These stylets serve not only to draw nourishment from the plant, but also provide a means of attachment to the plant for the insect itself.

Later, the females molt a second time and become adults, and the males, after further metamorphosis consisting of five instars, develop into two-winged adults. The immature male scales are very much smaller and more slender than the adult females. In general, the color of both sexes is essentially the same, although the male scales may be paler. Shortly after emerging, the adult winged males mate with the females and die within a short period thereafter. After fertilization the adult females increase in size very rapidly and either commence egg laying or produce living young.

There may be from one to as many as six generations annually, the winter being spent in the egg, immature or adult stages, or in all three. During the warmer seasons there appears to be much overlapping of the broods, and all stages may be evident at one time.

COLLECTING AND PRESERVING DIASPIDIDS

The chief requisite in collecting diaspidids is keen observation and perseverance. Armored scale insects may be found on the leaves, fruit, twigs, branches, trunks, and crown not only of fruit trees but also of forest and shade trees, ornamental trees and shrubs, and, as a matter of fact, on all types of plant life including grasses. Even garden plants are infrequently attacked, and a few hours spent in a large greenhouse where a wide variety of plants is grown usually reveal several species. The beginner should prepare a list of diaspidids he has not found, together with the host plants they attack, and then be on the lookout for these particular hosts. Equipment needed to collect diaspidids includes only a sharp, strong knife, a pair of pruning shears, paper sacks, and different sizes of coin envelopes. The larger twigs and branch material may be put into the paper sacks, and the coin envelopes will accommodate the smaller plant parts, such as pieces of infested bark and leaves. It is advisable to put only a single species from a given host into a sack or envelope and indicate thereon the locality, date, host, and collector.

Diaspidid scale material which is brought to the laboratory from the field is best preserved by drying. Larger stems and bark chunks may be cut to the size of the envelope for filing. The infested plant parts should be fumigated with napthalene flakes to kill the crawlers or first-stage nymphs of the scale insects. When the scale material is thoroughly dried it may be placed between layers of Cellucotton and put into envelopes or small cardboard boxes. The California State Department of Agriculture uses a manila envelope $3\frac{3}{8}" \times 6"$ with blanks for the specific name, accession number, host, place collected, origin (for Plant Quarantine material), date, and collector's name. After genus and species name are printed or written, the envelopes are filed in $4" \times 6"$ metal filing drawers. Stanford University uses a $3" \times 4\frac{1}{2}"$ cardboard box which varies in thickness to accommodate different size infested plant parts. These are filed in specially constructed wood cabinets, with partitioned drawers. It seems inadvisable to preserve diaspidid material in alcohol. Exhibit collections of armored scales are best placed in flat cardboard boxes filled with cotton and covered with glass tops which hold the infested plant material in place. These are called "Riker Mounts" and may be purchased from most biological supply houses.

When diaspidids are to be submitted for determination, infested plant parts should be wrapped in soft tissue paper, sealed in a coin envelope with a few crystals of napthalene or paradichlorobenzene to assure complete kill, and the collection data written on the outside of the envelope. An identification slip is provided by the state, and the coin envelope may be clipped to it and placed in a larger envelope or mailing tube to be sent to the State Department of Agriculture, Bureau of Entomology, 1220 N Street, Sacramento, California.

PREPARATION OF MOUNTS

It must be borne in mind that a study of the Diaspididae involves an examination of microscopic characters which are of taxonomic value. The insects must be specially prepared for this. Two kinds of microscopic glass slide mounts, temporary or permanent,[1] are made. Temporary mounts are useful in a regulatory office such as the State Department of Agriculture where large quantities of scale material are sent for identification. A rapid determination of the more common forms is possible within a few minutes after the temporary mounts have been made. The following procedure is used in preparing temporary mounts of the Diaspididae:

1. Remove the body of the insect from beneath the covering, or place entire armored scale in a 1-inch handled crucible, filled three-fourths full with distilled water to which has been added two pellets of potassium hydroxide (KOH).
2. Heat crucible until solution boils.
3. Remove scale body from crucible and transfer to depression slide, rupture anterior part of body (prosoma) with edge of probe, and tease out body contents until specimen appears as a clear, membranous sack.
4. Transfer cleared specimen to droplet of so-called gum-chloral hydrate or chloral-hydrate media (see formula below). Apply cover slip and heat slide on hot plate until media boils slightly. The specimen is then conditioned for examination under the compound microscope. Valuable specimens are recoverable from this media for permanent embedding in Canada balsam.

The formula used to prepare chloral-hydrate media follows:

Gum Arabic	1 gram
Dextrose	1 gram
Chloral hydrate	10 grams
Iodine crystals . .	1/10 grams
Glycerin	1 cc.
Water	1 cc.

Grind mixture of solid ingredients in mortar. Place in screw-cap vial and add water to desired consistency, which cannot be finally determined until all parts have dissolved.

The most satisfactory method of studying diaspidids is by the use of permanent or stained mounts preserved in Canada balsam. Stained preparations present the important morphological details for specific identification and preserve the specimens almost indefinitely. With the method described below it is possible to prepare a permanent stained mount within a fifteen-minute period, although twice this time is recommended. The following steps used in the preparation of permanent diaspidid scale mounts are:

1. Remove body of diaspidid female from beneath scale covering, or place entire specimen in a 1-inch handled crucible, filled three-fourths full with distilled water to which have been added two pellets of potassium

[1]The following article presents an excellent treatment of mounting procedures, especially for temporary mounts and for permanent mounts of mealybugs and soft scales: H. H. Keifer, Journal of Economic Entomology, Vol. 39, no. 5, pp. 665-666 (1946).

hydroxide (KOH). Heat crucible until solution boils.
2. With an eye dropper, remove scale body from hot KOH in crucible and transfer to depression slide. With the edge of a probe or needle rupture anterior part of body (prosoma) and tease out body contents until specimen appears as a clear, membranous sack.
3. Transfer cleared specimen to distilled water in clean depression slide. Wash thoroughly and let stand in water for two or three minutes.
4. Fill clean depression slide with 50 per cent ethyl alcohol, add basic fuchsin (magenta) crystals and stir until solution becomes a deep blood-red color. Transfer washed specimen to alcohol-basic fuchsin and leave in stain for at least five minutes.
5. Transfer to glacial acetic acid in clean depression slide and carefully tease out excess stain from specimen. Since glacial acetic acid is extremely active as a destainer, care should be exercised not to destain too much.
6. Transfer destained specimen to oil of cloves in clean depression slide, and leave in this solution for not less than five—preferably twenty—minutes.
7. Transfer to xylene in clean depression slide and wash thoroughly for one or two minutes.
8. Place specimen in droplet of Canada balsam on a glass microscope slide and apply glass cover slip. Use as little balsam as possible to facilitate examination under compound microscope, especially under the oil-emersion magnification.

When the balsam has hardened the cover slip may be ringed with shellac or other suitable medium to prevent later checking of the balsam.

HABIT AND DETAILED MORPHOLOGICAL CHARACTERS

Professor G. F. Ferris (1942) has very adequately dealt with the habit and morphological details of the Diaspididae in his *Atlas of the Scale Insects of North America.* I am in complete accord with Professor Ferris' observations and ideas, and these are here presented *verbatim*, except for certain omissions, as they occur in the *Atlas.*

THE NORMAL DIASPIDID PATTERN

Habit

"The habit pattern of the majority of the Diaspididae is exceedingly well marked and constitutes the chief basis for the superficial recognition of the group, it involving normally the formation of the scale which is composed of exuviae and of secretionary material."

The Scale of the Female

"The normal procedure is for the larva to insert its mouthparts into the tissues of the host, to grow to a certain extent, and then to shed its skin. During this period of growth a certain amount of waxy secretion is usually produced over and around the body. The derm of the dorsum becomes more or less heavily sclerotized, while that of the venter remains membranous. Exuviation involves the rupturing of the ventral derm, usually around the anterior margin of the body; it being then pushed back to the posterior end.

"At this molt the legs are entirely lost, except rarely for minute vestiges, and the antennae are reduced to mere unsegmented tubercles.

"The insect in the second stage, being legless, remains beneath the exuvia of the first stage, inserts its beak, and resumes growth. During this period of growth wax is usually secreted over and around the body, forming an extension of the secretion produced during the first instar.

"When the insect has reached the limit of growth of the second instar, the derm of the dorsum becomes sclerotic. In perhaps the majority of species the derm of the venter remains membranous although in some species it may become as sclerotic as that of the dorsum, while in others it may be partially sclerotized.

"Exuviation occurs in one of three ways. In many species the membranous ventral derm ruptures about the anterior region of the body and is pushed back to the posterior extremity, remaining attached there to the dorsal derm. In some other cases, when the ventral derm becomes more or less sclerotized, the rupture may take place around the posterior portion of the body, leaving the dorsal and ventral parts attached to each other at the anterior end. In these cases the ventral derm becomes incorporated in a ventral scale and may at times become entirely separated from the dorsal skin. The third method of exuviation involves an actual shrinking of the body of the adult female, which remains entirely enclosed within the exuvia of the second stage. In such cases the species is here characterized as being 'pupillarial.'

"In the non-pupillarial forms, growth is resumed by the adult female, which again inserts its beak into the tissues of the host and feeds. The insect,

being legless, still lies beneath the scale, which is now composed of two exuviae and of the secretionary material that was formed during the first two instars. To this material is added more wax which is produced by the adult female. In some forms a certain amount of waxy material appears on the ventral side of the body and the insect may be entirely enclosed within a complete shell. In others a dorsal scale alone is formed. There may be various transitions between these two conditions.

"At full maturity the female begins depositing her eggs, and as the body contents are converted into ova and extruded, the female shrinks until finally she is reduced to a little, shrivelled body lying at one end or to one side within the enclosing scale, the remainder of the space being filled with eggs.

"There is some correlation between the shape of the insect and that of the scale. Elongated species usually produce a long scale, while the more rotund species produce a circular or oval scale. In some cases the exuviae may lie over or close to the center of the scale, and it seems probable that in such instances the insect, in at least the adult stage, has rotated about a pivot formed by the mouthparts."

The Scale of the Male

"The complete story of what happens in the development of the male has been worked out in but few species. We may adopt the description given by Stickney[2] of the conditions found in *Parlatoria blanchardi* as typical.

"The first larval stage of the male has not been demonstrated to be different from that of the female although there is a possibility that in some forms differences may exist between the sexes at this stage. Exuviation is similar to that of the female, the first exuvia being sclerotized in the same manner.

"The second stage of the male has lost the legs and antennae as in the female. In those forms that have been carefully studied, the insect in this stage seems to be in general very similar to the corresponding stage of the female, but some material that is at hand indicates that in at least some species it may be quite different in its pygidial structures. In any case, the second stage produces a certain amount of secretionary material which forms a waxy appendage at one end of or surrounding the first exuvia. In many species the character of the waxy secretion is quite different from that of the female, it tending to be composed of individual threads which give a felted appearance to the whole. In some cases, especially in the Aspidiotini, the scale is in texture similar to that of the female.

"The second instar of the male never becomes strongly sclerotized, and the exuvia does not enter into the composition of the scale, being pushed back inside the scale in a little crumpled bundle.

"At the second molt the mouthparts are lost. In some species, at least, there follow a prepupal and a pupal stage, the adult male emerging from the latter. In both these stages the exuviae are membranous and delicate.

"The scale of the male, then, consists normally of one sclerotized exuvia and of a certain amount of waxy secretion."

Departures from the Normal Habit

"As has been pointed out, in a number of species the adult female remains within the exuvia of the preceding stage, this exuvia in such cases always being more or less heavily sclerotized throughout. It ruptures about the posterior end, in one way or another, to permit the escape of the larvae.

"A few forms are known in the Phoenicococcinae in which one or even two additional larval stages are present in the female, the exuviae of these stages being retained within the exuvia of the second stage.

"In one known North American species, *Praecocaspis diversa* Ferris, the adult female issues directly from the first larval stage. In a few cases, in the Phoenicococcinae, the male goes through its development while encased within the first larval exuvia."

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[2]F. S. Stickney, United States Department of Agriculture, Technical Bulletin number 421 (1934).

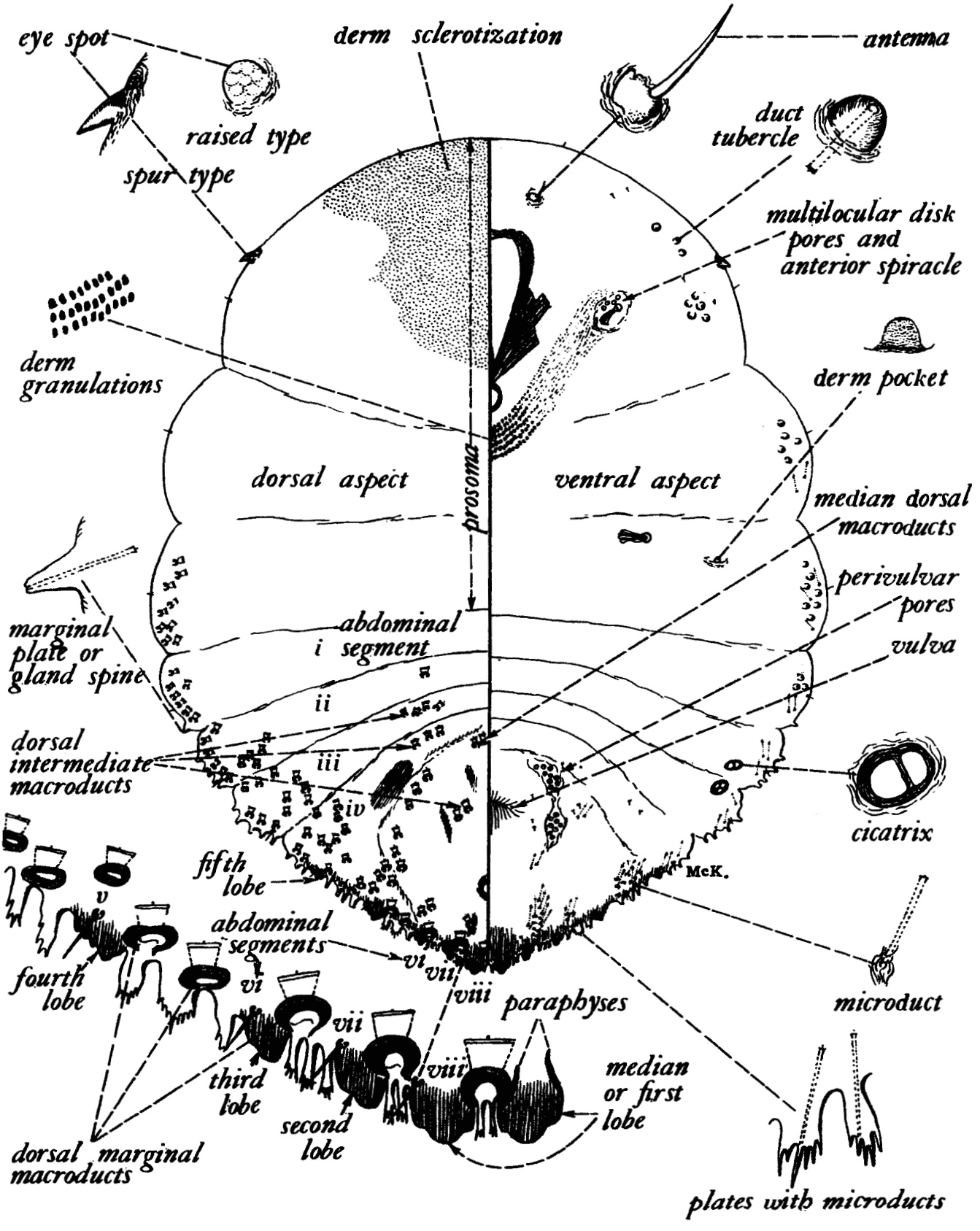

Fig. 1. Generalized and semidiagrammatic drawing representing the genus *Parlatoria*. Morphological structures of typical Diaspididae.

MORPHOLOGY

"We are here especially concerned with the problems of specific identification, and these rest almost entirely upon the morphology of the adult female. In a relatively small number of cases reference must be made to the second stage. The first stage larvae, while undoubtedly of aid in the development of a general classification, are as a rule of no help in the identification of genera and species, although at times they furnish confirmatory or supplementary information. The males are entirely useless for anything except the broader aspects of classification. Consequently, the remarks which follow will be devoted primarily to the adult female, with lesser notes on the second stage and only a few remarks about the larvae. The males will be disregarded."

The Adult Female

Segmentation of the Body

"Throughout the Diaspididae there is a strong tendency for the segments of the body to become more or less fused into tagmata which do not entirely follow the pattern of 'head, thorax, and abdomen' that is conventionally ascribed to all insects.

"As in all the Coccoidea, the head and the two succeeding segments become quite closely fused. The region composed of these parts frequently becomes much enlarged, at times comprising the greater part of the body, and it is very frequently quite definitely separated from the metathorax by constriction. For this reason it is at times convenient to have available a term characterizing this region, and it is here spoken of as the 'prosoma' . Figure 1 is a generalized and semidiagrammatic drawing representing the genus *Parlatoria.* It illustrates morphological structures of a typical Diaspididae.

"The metathorax is frequently more similar to the first abdominal segment than it is to the mesothorax. It is at times convenient, therefore, to regard this segment and the abdomen as forming a 'postsoma.'

"The opinion is here adopted that the insect abdomen is composed basically of eleven segments, the eleventh bearing the anus, and that the vulva of the female is usually between the eighth and ninth segments. If we adopt this view and proceed to an examination of the Diaspidid abdomen, we find that certain segments appear to be missing and that certain others have a strong tendency to fuse together. Not more than eight abdominal segments can be identified in any Diaspidid as distinct entities, these apparently being the first to eighth, and we must assume that the ninth to eleventh segments have been greatly reduced.

"The interpretation of the abdominal segmentation, however, is somewhat difficult and in some respects uncertain. The assumption that the vulva is between the eighth and ninth segments may be wrong, there being the possibility that it is actually between the seventh and eighth segments. If it is really between the eighth and ninth we must assume that the eighth sternite is very much reduced. The dorsal side of the body permits somewhat more definite conclusions. If we reason from the conditions found in certain more generalized Coccoidea, where the abdominal spiracles are retained, and if we carefully follow the count of certain fixed setae that seem in part to be segmentally arranged, we can arrive at rather definite conclusions. The author differs by one segment from the interpretation given by Stickney in the paper to which reference has been made.

"A reference to figure 1, illustrating morphology, should make the subject clear. It is here held that the median lobes at the apex of the body belong to the eighth abdominal segment. Since the anus belongs morphologically to the eleventh segment it is clear that the ninth, tenth, and eleventh segments have become much reduced. The narrow median area posterior to the anus should include the morphologically ventral areas of at least the eleventh and tenth segments. On the ventral side the area immediately posterior to the vulva should represent either the eighth or ninth sternites. The peculiar development of the so-called pygidium arises from the fact that the segments anterior to the ninth have been bent posteriorly, thus folding around the now almost or quite obsolete ninth, tenth, and eleventh segments. This backward folding has gone so far that the lateral lobes of the eighth tergite come almost into contact behind the anus. In fact, in some forms they have actually fused together at their posterior extremities. In addition to this, the eighth and preceding segments tend to become closely united to each other, with intersegmental lines being more or less suppressed.

"In all the species here regarded as belonging to the Diaspidinae, this union of segments has proceeded so far that certainly all segments forward to the fifth are involved, while in some forms even the fourth segment enters into the composition of the pygidium. In the Phoenicococcinae, except for *Phoenicococcus* itself in which no fusion occurs, this uniting of the termal segments does not proceed farther forward than the sixth at the most, and at times perhaps not even so far.

"The compound structure thus formed by the fusion of segments is usually rather definitely marked off from the preceding abdominal segments, although in some forms its anterior limits are not clearly definable. This region forms the 'pygidium.' The term as here used certainly does not imply the same morphological relationships as it does in some other groups, but it has been used so extensively in connection with the Diaspididae that it could not now be altered.

"The determination of the segments can best be accomplished by counting the marginal setae of fixed position, beginning with the seta at the lateral basal angle of each median lobe and counting outward. These setae are of very definite position and are retained even after all other evidence of segmentation has been suppressed. In some forms the segmental lines are indicated, at least on the dorsum, by furrows, or by intersegmental sclerotizations that are concerned with muscle attachments, or by rows of ducts that follow the segmental lines. (See fig. 2.)

"In general there is a tendency for the dorsum of the pygidium to be more or less heavily sclerotized, although this sclerotization usually does not involve all the segments that are involved in the pygidium and is at times entirely lacking."

The Antennae

"In all the species here regarded as belonging to the Diaspididae the antennae of the adult female are reduced to unsegmented tubercles, or even to minute, sclerotized points. Normally they bear setae, which at times are somewhat 'fleshy' and are perhaps of a sensory nature.

"For the most part the antennae offer relatively little as a basis for the recognition of species and genera, although in a few cases they are modified in distinctive ways. In a few forms they are noticeably enlarged or elongate, or bear enlarged setae. They have some significance in connection with the larger groups. In general it may be said that the antennae in the tribe Diaspidini of the subfamily Diaspidinae tend to have two or more setae, frequently several, while in the Aspidiotini they rarely bear more than one seta. The distinction is by no means absolute, but has a degree of validity."

The Eyes

"The eyes are probably present in the adult female of all species, although they are frequently so reduced that they are scarcely detectable in preparations. Their normal appearance is that of a weakly sclerotized spot with a smooth surface which distinguishes it from the surrounding slightly striate derm. Ordinarily they lie at the margin slightly anterior to or just laterad of the mouthparts. Usually they may, for our purposes, be disregarded, but they are subject to occasional extraordinary modifications. Perhaps the most unusual development is that to be seen in the North American species, *Velataspis cornigera* Ferris, where they form prominent, sclerotized, spinose structures, or in *Velataspis mimosarum* (Cockerell) where they are in the form of 'starfish-shaped' tubercles."

The Legs

"The Diaspididae are usually considered to be legless after the first molt, but in a few forms there appear structures which, on the basis of their number and position, seem to be leg vestiges. They never, in any known form, consist of anything more than a spinelike, sclerotized tubercle. Among North American species they are to be found in *Dactylaspis dactylifera* Ferris and *Dactylaspis crotonis* (Cockerell) and in the genus *Opuntiaspis*. The opinion here held is that their presence has no special phylogenetic significance, other than to indicate that a species possessing them is in this one respect somewhat generalized in classification."

The Mouthparts

"For the purposes of this work the mouthparts seem to have no significance, and they are dismissed from consideration."

The Spiracles

"In general the spiracles offer but little that is of any importance to taxonomic work in this family.

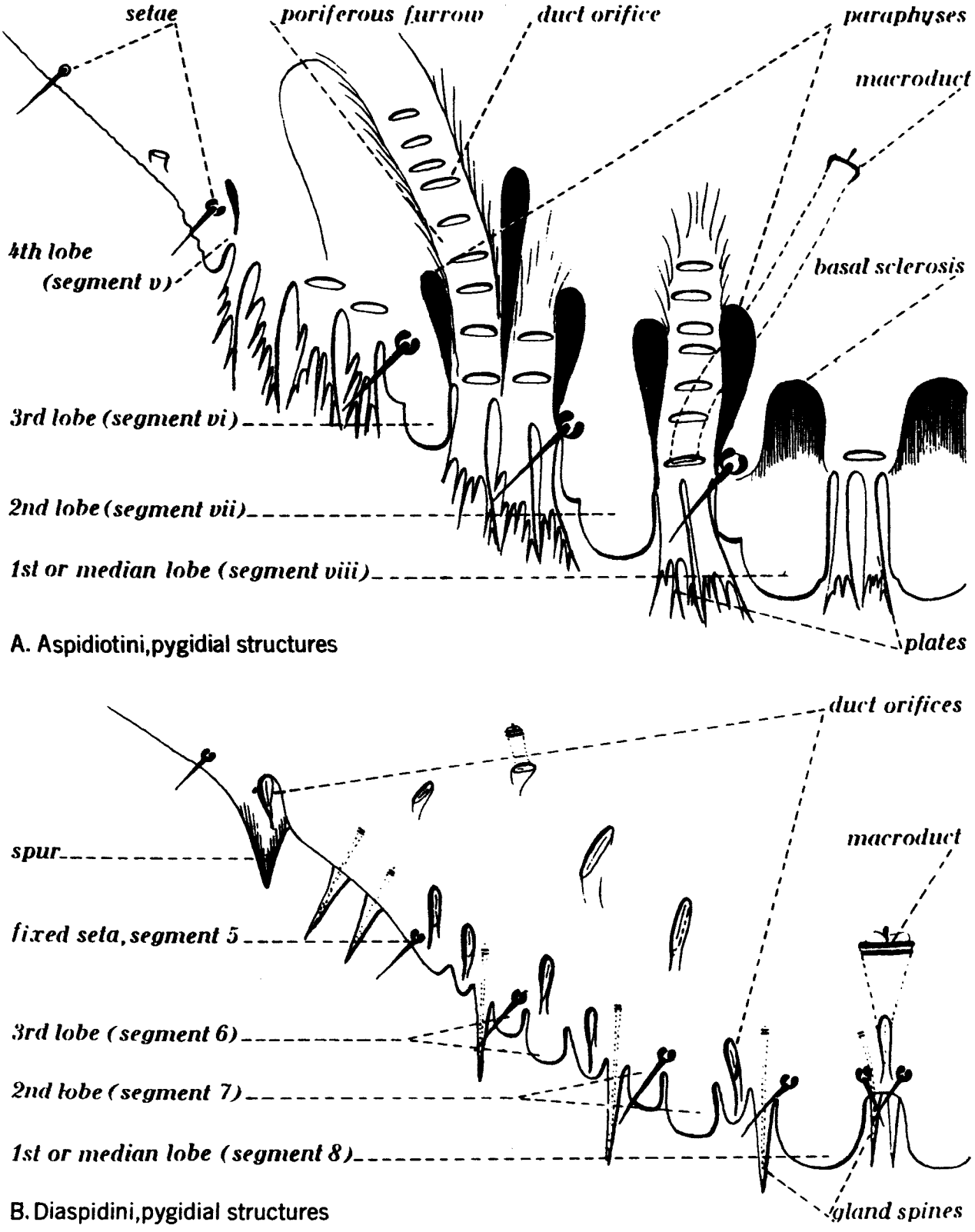

Fig. 2. (A) Pygidial structures of Aspidiotini; (B) Pygidial structures of Diaspidini.

Occasionally there are modifications that are perhaps of some slight value. They have been figured for all the species, chiefly as a concession to those who would expect them to be treated and would complain if they were not. There appears, however, one feature of some interest. It may be noted from the illustrations accompanying the various species that as a rule there are no disc pores associated with the spiracles in the Aspidiotini, while as a rule one or more pores are present in species of the Diaspidini. The difference is by no means absolute, since a few Aspidiotini, such as species of *Pseudaonidia*, have large clusters of pores in connection with the anterior spiracles, while some of the Diaspidini have none. As a rule they are, if present at all, more numerous in connection with the anterior spiracles."

Setae

"Probably every species of the family has a certain number of setae present. Some of these setae are of primary importance in determining the basic segmentation of the abdomen since they occupy fixed positions. They are consequently of more importance for morphological studies than for purposes of identification. Usually a certain number of setae are present around the prosomatic region, but as these seem very rarely to offer any help in systematic work they have been ignored and are shown only in the very few cases where some unusual development in numbers or size occurs.

"The setae of the pygidial segments at times present unusual developments of length or of shape. In *Morganella longispina* (Morgan), for example, they are extraordinarily long. In some of the species of *Duplachionaspis* the submarginal setae on the ventral side of the pygidial segments are unusually large."

Disc Pores

"Quinquelocular disc pores may be present in association with the spiracles or in groups about the vulva, rarely elsewhere upon the body. The pores about the spiracles have already been discussed.

"The pores in the region of the vulva are commonly referred to as the perivulvar or paravulvar or circumvulvar or perivaginal pores. The term perivulvar is here employed. These pores may be regarded as a part of the basic structure of the Diaspididae, that is, they were probably present in the original ancestors of the group. They are absent in many species, but it seems much more reasonable to suppose that they have been lost many times than to assume that they have independently developed many times. Their presence or absence has in the past been much employed in the forming of generic concepts, but it now seems clear that, taken by themselves alone, they have comparatively little significance for determining relationships. There are several instances of two species which are so similar in many respects that they must be regarded as closely related, yet one of them will possess these pores and the other will lack them. The best that can be said of them is that they may constitute convenient key characters for purposes of identification.

"The most common, and perhaps the fundamental, arrangement of these pores is in five groups, a median group just anterior to the vulva and two groups at each side. The median group shows a strong tendency to disappear and in many species is represented by one or a few pores, or it may be present or absent within the same species. In some cases the groups tend to fuse, although ordinarily even here a suggestion of five usually may be seen. In a few cases, apparently through secondary division of the groups, as many as seven may be present. In the genus *Leucaspis* small pore groups are present on additional segments anterior to those normally found. In a few cases the pores are present in a continuous row. In some species there is a strong tendency for supernumerary groups to appear sporadically. Such is the case notably in *Carulaspis visci* (Schranck), in which an appreciable percentage of specimens will show this condition in one way or another.

"The morphological position of these pore groups is somewhat doubtful. In the great majority of species the fusion of segments on the ventral side of the pygidium has been carried so far that segmental limits are entirely obscured. The only thing that can be said is that the pores seem to be morphologically prevulvar and consequently can not belong to any segment posterior to the eighth. In one North American species, *Opuntiaspis carinata* (Cockerell), the segmentation of the pygidium both dorsally and ventrally, is unusually well indicated, and in this species there is at least a suggestion that the groups are not all on the same segment. It is possible, from this species, to arrive at the conclusion that the median group belongs to the eighth segment, the anterior lateral groups to the sixth, and the posterior lateral groups to the seventh. The writer, in fact, has in an earlier paper adopted this opinion. However, further study

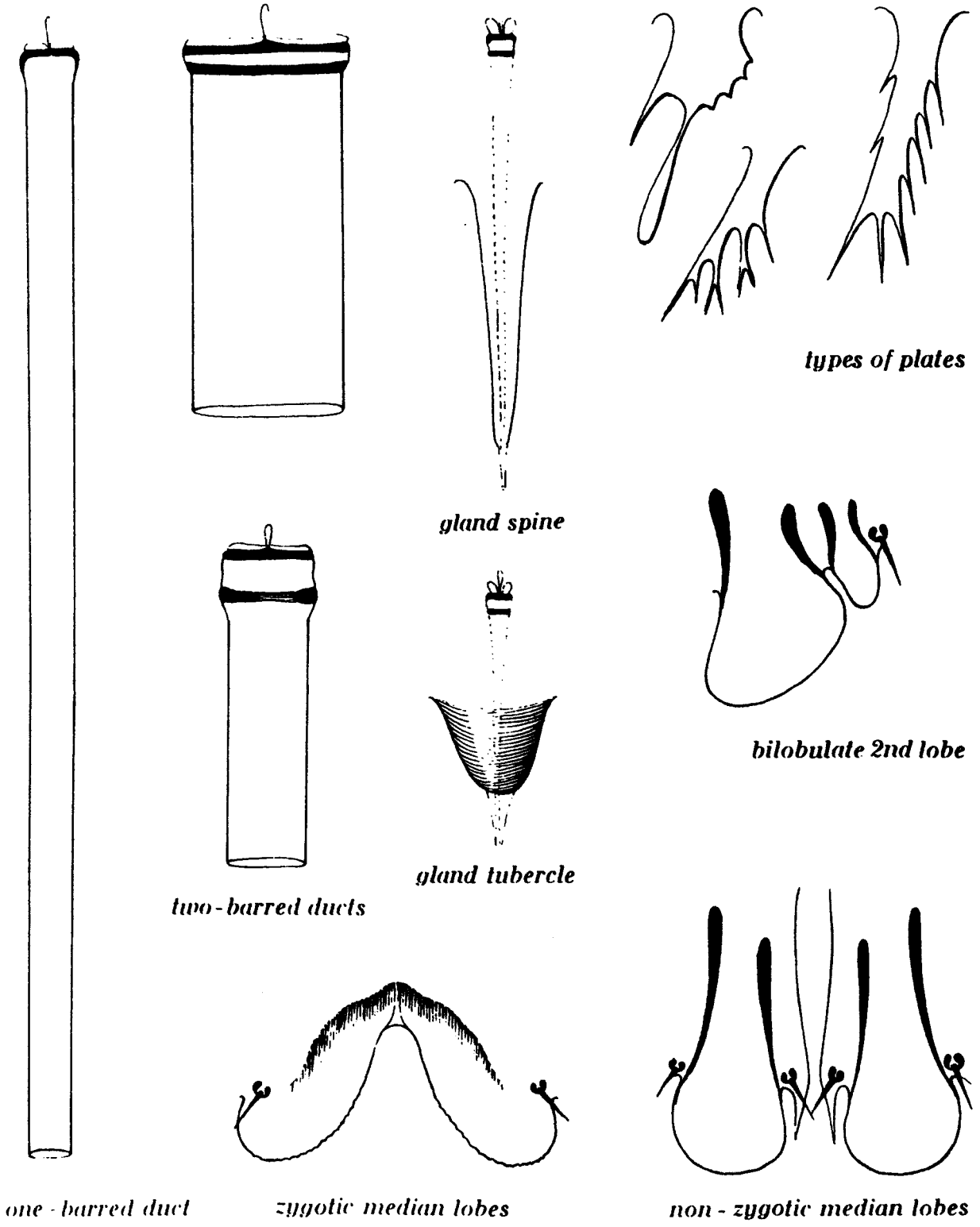

Fig. 3. Types of pygidial tubular ducts, lobes, plates, gland spines and scleroses of Diaspididae.

indicates that the distribution of the segmentally arranged setae is not in accord with this interpretation. On the basis of these setae the indications are that the groups of pores are actually all on the seventh segment and that the eighth sternite, which comprises the anterior border of the vulva is probably much reduced. Such is the interpretation herein adopted. The exact answer to the question is not of great importance for our immediate purposes."

The Types of Ducts (Fig. 3)

"The wax which composes the secretionary portion of the scale is produced by glands that discharge through tubular ducts. No extensive histological study of these glands and their associated pore and duct apparatus has yet been made, and the few limited studies that exist are quite unsatisfactory. Consequently, at the present time we can do nothing more than to use roughly descriptive terms that will characterize the major types of ducts as they are seen in the preparations used for taxonomic study. We cannot say what the various appearances thus seen actually mean or be entirely certain as to their real value in indicating relationships. There seem, however, to be certain rather obvious facts concerning them that are of aid in taxonomic work.

"In general all of these ducts may be described as tubes which seem almost always to be more or less compressed and therefore more or less narrowly oval in cross section. The outer end of the tube is open and forms the external orifice through which the products of the associated gland are discharged. The inner end is closed except for very minute openings into one or more filamentous extensions of the tube. These extensions lead to the gland cells which are, of course, not to be seen in preparations intended for taxonomic study.

"At this inner end of the duct there are various structures the actual functioning of which is not at all explainable on the basis of present knowledge. We need concern ourselves here with but a portion of these structures, primarily with the apex of the tube itself. In practically all the Diaspididae, the inner end of the duct is truncate and seems to be closed by a strongly sclerotized transverse wall that as seen under the microscope ordinarily appears as a transverse bar. The lateral walls of the tube also are more or less strongly sclerotized for a short distance, and the terminal structure appears as a slight swelling of the apical extremity of the tube.

"Many of the ducts are so exceedingly minute that it is difficult, or with any ordinary optical equipment and methods of preparation, impossible to see clearly, what the actual structure of this terminal enlargement is. On the basis of present knowledge we must confine ourselves primarily to the larger ducts, those for which the descriptive term 'macroducts' is commonly used.

"These macroducts seem in general to fall into two types.

"In one type the duct is relatively very short and broad, its length at times not being more than two or three times the breadth of the truncate inner extremity. In ducts of this type the closure of the inner end seems to be formed by two parallel, transverse, sclerotized bars. See figure 3. What the real situation is functionally and histologically no one knows, but descriptively these have been called throughout this work 'two-barred' ducts. There are variants, especially in ducts of smaller size, where the bars seem to become more widely separated from each other, but in general the type is clearly recognizable.

"This 'two-barred' type appears with great constancy throughout the group that is here regarded as the tribe Diaspidini of the subfamily Diaspidinae. The ducts may at times be so exceedingly small that their character is obscured, but aside from this, there are only two species known in which wide departures from the normal form exist. In two North American genera, *Mitraspis* and *Praecocaspis*, the inner extremity of the ducts has been greatly modified in ways that may be seen by reference to the descriptions of these genera. Occasionally ducts of this type may be much elongated, being many times as long as wide, but this is relatively rare.

"The second general type includes ducts that are almost always long and slender, the length being ordinarily at least ten times and in some forms perhaps as much as a hundred or more times the breadth. In the ducts of this type the closure of the inner extremity appears as a single transverse terminal bar and throughout this work these ducts are characterized as 'one-barred.' See figure 3. They are characteristic of the tribe Aspidiotini of the subfamily Diaspidinae. In some forms they are exceedingly minute and consequently their characters become obscured. It is not always possible to say whether exceedingly small ducts are of one type or another.

"In a very few species of the Aspidiotini, the macroducts are quite short and broad, and occasionally there is a faint suggestion of a 'two-barred' condition, such—most unfortunately—being in *Aspidiotus hederae*, which is the nomenclatorial

type of its tribe. However, repeated examination has shown little real difficulty in distinguishing the two types.

"In the subfamily Phoenicococcinae and in at least some species of the Diaspidini, especially in the larva, there appear macroducts which cannot be assigned to either of the preceding types. These ducts, in cross section, present the appearance of a figure 8, this being occasioned by the presence of a median partition. In the Diaspidini they are present commonly as a pair on the head of the first-stage larva, but they may also occur elsewhere. They call for further study in order to determine their taxonomic value.

"In addition to the macroducts there are present—apart from merely small macroducts, if we may employ such a contradiction—exceedingly minute ducts that seem to be of various types and that have not yet been subjected to critical study because of their minuteness. Ordinarily they are associated with specialized structures such as the 'plates' and 'gland spines' which will be described later."

The Pygidial Lobes (Figs. 2 and 3)

"In a very large portion of the Diaspididae, the pygidial segments are in part produced at their lateral margins into flattened, sclerotized processes that are commonly called 'lobes.' The number of pairs of lobes is variable, but if any at all are present they are commonly those of the eighth segment, which, because of the pronounced arching of this segment, lie side by side at the apex of the pygidium. If a second pair is present it normally is that belonging to the seventh segment. If a third pair is present it belongs to the sixth segment. In a relatively small number of species a definite fourth pair, belonging to the fifth segment, may be found.

"Obviously the members of the median pair, belonging to the eighth segment, were originally separated from each other by the ninth, tenth, and eleventh segments, and in perhaps the majority of species they still remain distinctly separate. But in some species the reduction of the three originally terminal segments has gone so far that the median lobes are fused at their bases, and in some cases this process has proceeded so far that they are fused even to their apices and constitute a single, median lobe. This process seems to have happened independently several times in the Diaspidini, Aspidiotini, and Odonaspidini.

"In some species the lobes have become entirely obsolete, even the median pair no longer appearing. Again this condition seems to have arisen independently in the Diaspidini, Aspidiotini, and Odonaspidini. In such cases the segmentally arranged setae, which are normally present at the bases of the lobes, almost always remain to mark their position."

The Plates and Gland Spines (Fig. 3)

"In addition to the fringe of lobes about the pygidial margin, there are present in most of the Diaspidinae other marginal structures that are usually entirely or at the most but little sclerotized and that in preparations appear as hyaline processes. These are the 'plates,' 'squames,' 'pectines,' or 'gland spines' of various authors.

"In general these structures fall into two types. The simplest type is merely an elongate conical process, rarely bifid or slightly fimbriate at the extreme tip. Through this process there always extends a slender microduct, or at times more than one, the orifice of which is at the apex of the process. These processes are at times extremely conspicuous, but they may be very small or reduced almost to the point of unrecognizability. For them the term 'gland spines' was proposed many years ago by Cooley and this term is here employed.

"These gland spines occur primarily, if not exclusively, in the tribe Diaspidini of the subfamily Diaspidinae.

"The gland spines grade off into a shorter, basally swollen and sclerotized form that is here spoken of as a 'gland tubercle.' Such tubercles are extremely conspicuous features of many of the Diaspidini.

"The second type of membranous marginal pygidial process involves structures that are almost always more or less branched or fimbriate, sometimes most elaborately so, although at times they may be much reduced and unbranched. In many cases there is definitely a single microduct discharging at the apex of one of the points or branches, but in other cases there is either none at all or it is so exceedingly minute that it eludes notice. These structures are here called 'plates,' a term that certainly has little to commend it but which has been much used by American authors and consequently is familiar.

"These plates are present primarily in the tribe Aspidiotini of the Diaspidinae, but entirely equivalent structures occur in *Parlatoria* and related genera which are here regarded as belonging to the Diaspidini. They may at times be entirely

lacking and at other times can scarcely be distinguished from much reduced gland spines, but in general their presence is characteristic of the Aspidiotini and usually they can definitely be recognized."

Pygidial Scleroses (Fig. 3)

"Along the margin of the pygidium there are frequently present sclerotic structures that are at times conspicuous features. These structures are commonly referred to as 'paraphyses' or 'thickenings.' For them the general term 'scleroses' is here employed. It is probable that a close analysis of their occurrence and function will permit their division into several types, but for ordinary purposes only two such types need to be considered.

"It is not at all uncommon for the sclerotization of each of the median lobes to be prolonged basally in a structure that is as wide as the base of the lobe itself, and occasionally this basal sclerosis is sclerotized and deeply pigmented. Such an occurrence is quite frequent, especially in the Aspidiotini.

"At other times the basal sclerosis of the median lobes may arise merely from one angle of the base and be more or less narrowly joined to the lobe. Occasionally such a structure becomes extraordinarily developed, as in *Howardia biclavis* (Comstock). In its extreme development it seems to have a character that is different from the ordinary basal sclerosis, but it is difficult to say exactly wherein the difference lies, and perhaps the making of any special distinction is unnecessary.

"Structures of this sort in connection with the median lobes seem to be attached primarily to the derm of the dorsum. There are other developments that arise entirely from the ventral derm. In many of the Diaspidini, especially, there are present a pair of variously developed, rodlike scleroses that extend from the basal angles of the median lobes and even of the second or at times the third lobes. They are certainly different from the other type that has been discussed, and in the Diaspidini their presence is associated with an apparent natural division of the tribe. If they are present the median lobes are separate from each other. At times when they are lacking, the median lobes are united basally by what is apparently an internal sclerotization that is here spoken of as a 'zygosis.'

"Basal scleroses may arise also from other lobes than the median and may be of the same type. At times they take the form of very long, slender, deeply pigmented rods. They are to be seen in especially extreme development in species of the genus *Melanaspis*.

"In addition to these, however, there may be present also marginal scleroses that arise in the spaces between the lobes, such structures being very highly developed in *Melanaspis* and related genera. For all these slender rods the general term 'paraphyses' is here employed.

"In certain of the Aspidiotini these paraphyses take a special form of development and occupy a special place. In various genera, such as *Diaspidiotus*, they are present in pairs, one pair in each interlobular space. They apparently arise as extensions of the corresponding lobes and seem to function as supports for the body wall which is here weakened by the presence of at least a few orifices of macroducts. The condition seen in these genera is somewhat special and perhaps some special term should be employed to characterize it, but that will not be done here. The structures will be regarded as paraphyses. However, the distinction as to whether these paraphyses arise only from the bases of the lobes or whether they arise also within the interlobular space itself is an important one for the separation of some of the genera of the Aspidiotini."

Dorsal Pattern of Sclerotization of the Pygidium

"In some of the Aspidiotini, especially, the sclerotization of the pygidial dorsum is arranged in a quite definite pattern. Where this occurs there is normally a median area, which at the margin of the pygidium extends across between the bases of the second pair of lobes. This area then expands anteriorly as it approaches the anterior margin of the pygidium and at times has a 'wineglass' shape. There then follows a much smaller area which is based upon the third lobe and extends into the pygidium at the side of the stem of the median area. A third area may be present, arising from about the base of the fourth lobe and extending anteriorly at times to the dorsolateral scar."

Dorsal Pygidial Scars

"On the dorsum of the pygidium, toward the anterior margin, there are commonly present a series of sclerotized areas which are associated with

dermal folds. The probabilities are that these areas are arranged more or less along segmental lines and that they are the surface indications of phragmata for the attachment of muscles. It is at times convenient to employ them as points of reference, and they are here referred to as 'scars.'"

The Anal Opening

"The anus is characteristically merely a small, circular, or oval opening in the dorsum of the pygidial area. While at times there may be a more or less sclerotized ring around it, this ring is never cellular and except for one species—*Phoenicococcus marlatti*—neither bears, nor is associated with, any setae and never bears pores of any kind."

The Second Stage of the Female

"Ordinarily identification depends upon the adult female, but there are some forms in which the second stage must be considered for this purpose, and there are many cases where an understanding of relationships can be gained only by reference to this stage.

"In most typical Diaspididae there is a combined retrogression and progression in the development of structures from the first-stage larva to the adult, the loss or reduction of the antennae, legs, certain pores, and certain setae occurring at the first molt; the appearance of the vulva and its associated pores, if they are present at all, and the full complement of ducts, lobes and plates or gland spines not completed until the third molt. As a rule, then, the adult female is more complex than the second stage. The perivulvar pores and the vulva itself are never present in the second stage, while ordinarily the number of macroducts is greater in the adult than in the second stage. The positive identification of an individual as an adult female can be accomplished if perivulvar pores are present. If they are not present the positive identification of the vulva will indicate maturity.

"However, in those forms in which the adult female is retained within the exuvia of the second stage there is frequently something of a reversal of the normal procedure, the adult female having at times failed to develop some of the normal structures and even having lost some of those which were present in the second stage. At times the pygidial structures of the adult female in such pupillarial species may become strangely modified. So frequently is there reduction or modification of the adult in such species that for any understanding of the insect's relationships we must go back to the second stage. Here, ordinarily, we shall find at least some evidence remaining which will indicate the group to which the species belongs. It is, in fact, only upon the basis of the second stage that any sound understanding of many of these pupillarial forms can be achieved. There have been many misconceptions and errors concerning some of these species, all due to the failure to make any adequate examination of the second stage.

"As examples of these errors we may cite the following: The genus *Aonidia* has as its type a species which belongs definitely to the Aspidiotini, but the majority of the species which have been referred to the genus belong to the Diaspidini. The genus *Fiorinia* has as its type a species that is evidently a derivative from the group of which *Phenacaspis* may be regarded as typical, but species of quite different derivation have been referred to it. The genus *Leucaspis* has had referred to it a considerable number of species which, on the evidence of the second stage, have nothing at all to do with its type.

"Upon the data provided by the second stage it is evident that pupillarial forms have been developed independently in almost every group of the Diaspididae, as well as in various other families. Within the Diaspididae they have come from ancestors like *Diaspis, Phenacaspis, Parlatoria, Pseudoparlatoria,* and from undetermined genera of the Aspidiotini.

"The fact that in these pupillarial forms the second stage usually possesses structures which are lost in the adult is one of the reasons which lead the author to believe that the North American genus *Ancepaspis* should be placed in the Phoenicococcinae, for in this tribe the second stage is, in general, less complex than the adult; in other words the adult does not show retrogression that is commonly seen in the adults of other pupillarial forms.

"In the character of the antennae and spiracles and of the vestigial legs when present, the second stage resembles the adult."

The First Stage Larva

"It should be quite clear—and it has at various times been emphasized by the author—that a careful study of the first stage is highly desirable as

an aid to the development of a sound classification. However, this stage differs so definitely from the succeeding stages that its study is a distinct problem which could not be undertaken in connection with the present work. While ordinarily the first stage will not aid in identifying genera or species, it most certainly will aid in an understanding of broader relationships. All that it has been practicable to note in this work, however, is the character of the antennae and certain features of the cephalic region.

"The antennae have been figured in this Atlas whenever a specimen showing them could be obtained from the material at hand. They indicate little more than the fact that there are certain group characteristics.

"It will be noted in the figures accompanying this work that in the Aspidiotini the antennae are normally five-segmented and the terminal segment is elongate and annulate. There is but one exception, this being the peculiar *Comstockiella sabalis* (Comstock), the position of which is extremely doubtful.

"In the Diaspidini, however, the antennae of the first stage are of different types. They may be either five-segmented or six-segmented, and the terminal segment may be short and nonannulate or elongate and annulate. Whether or not this indicates that the Diaspidini are an unnatural group remains to be determined. The same thing is true in regard to the Phoenicococcini, where these types occur in apparently related forms.

"In many of the Diaspidini there is present on the dorsal side of the head of the first stage a pair of enlarged ducts, these usually showing an 8-shaped figure at the inner end when viewed apically. They are frequently lacking in this tribe, but in no case have they been seen in the Aspidiotini, and their presence is diagnostic of the Diaspidini."

CLASSIFICATION

It is indeed fortunate that there now exists a logical system of classification of the Diaspididae, one upon which I may rely for aid and accurate guidance. This monograph is Professor G. F. Ferris' *Atlas of the Scale Insects of North America.* His classification and definitions of the family, subfamilies, and tribes are here accepted and the following remarks have been taken with slight modifications as directly recorded by him in the *Atlas.* I gratefully acknowledge permission to use this data by Professor Ferris.

General Considerations

The development of a sound system of classification of the Coccoidea has in the past been retarded by several factors. One, undoubtedly, was for long the lack of any adequate technique in the preparation of specimens for study under the microscope. Without such a technique it is impossible to see and appreciate the structures if any sound basis for a system of classification is to be found. It was undoubtedly as a result of this deficiency that almost to the present day some students of the Diaspididae relied to a very large extent upon the character of the scale as a basis for generic concepts and paid very little attention to the structure of the insects themselves.

A second factor was the circumstance—more or less common to all entomology—that workers were more or less interested in the description of species than in the development of a classificatory system into which those species might be fitted. Like all entomology, the study of the scale insects has suffered from a sort of indigestion resulting from the attempt to do justice to the abundance of material set before it.

A third factor is that authors, when they have thought about it at all, seem to have thought of classification almost entirely in terms of "key characters," that is in terms of characters which because of their obviousness could be used in the processes of identification. Rarely have they thought in terms of the sum total of characteristics which constitute the actual pattern of a group.

Let us consider the genus *Aonidiella* as an example of this. This genus was based by Leonardi upon only two characteristics (both obvious in even the most deficient preparations): the absence of perivulvar pores, and the presence of paraphyses. He, himself, as a result of this concentration upon the obvious, produced a genus containing species that belong to four or five quite distinct generic groups. Later authors continued the process until eventually at least 46 species had been referred to the genus. Of these not more than four actually have anything to do

with the genotype, whereas several other species that are really congeneric with it were never referred to this genus. We now know nearly 20 species which, on the basis of the totality of their characters—a totality which produces a definite group pattern—seem to belong to *Aonidiella*. It is a homogeneous and biologically significant group, in other words it is now a genus and not an artificial aggregation of species thrown together on the basis of an arbitrarily selected, obvious character.

The same procedure has been repeated time after time. It is a procedure that results from the confusion of two quite different purposes which run through all systematic biology. One of those purposes is to develop a system of classification which will reveal significant relationships. The other is to develop a method by which a person who is unfamiliar with a group may identify species. These two aims are quite distinct and should never be confused.

For the development of a system of classification we must think in terms of the totality of characters, tangible and intangible, which make up a pattern. That pattern includes everything that can be learned about the organisms in question—their habits, their structure, their development.

But for the purposes of identification we must seize upon structures that can be readily seen. The more obvious they are, the more easily an identification is achieved. We are not concerned with the significance of the structures themselves. The perivulvar pores in the Diaspididae have little or no meaning in the development of a system of classification, but they are extremely useful aids as key characters in identifying a species.

In attempting to develop a system of classification of the Diaspididae I have endeavored to keep in mind the distinctions that have just been indicated. I have endeavored to arrive at conclusions as to the composition of genera and other groups without regard at all to the ease or difficulty which a student may encounter in identifying these groups. Thus, for example, the student will find species with perivulvar pores and species without perivulvar pores placed in the same genus because the totality of their characteristics indicates that they are thus related. And yet on the basis of all the evidence of structure, host relationships, distribution and habit, it is very evident that to separate them would be merely to obscure these facts.

The essential feature of this way of looking at classification is that the primary consideration is the existence of groups. The question of sharpness or vagueness of those groups, of ease of recognition, is subordinate and adventitious. It is a problem that should be approached only after our other purpose has been accomplished. Let us first then attempt to discover and to display the patterns which form the system of classification here adopted for the Diaspididae.

On the whole the Diaspididae are quite a homogeneous group, but there exist some forms which, although they seem to have their nearest affinities with this family, are connected with it only by almost invisible threads. In attempting to arrive at an understanding of the group we must first eliminate those forms which cannot be referred to it.

There must be excluded from consideration any form in which any but vestigial legs and antennae are present in the adult female; in which the anal ring is cellular and beset with setae; in which abdominal spiracles are present; in which any other than a simple and approximately quinquelocular disc pore appears; in which there are dorsal ostioles; in which there are brachial plates; in which there is an anal operculum formed by a pair of apically free plates; in which there are any tubular ducts with an asymmetrical internal termination.

There are thus left for inclusion in the family, forms which have some combination of the following positive characters in the female: antennae in all stages, except the first, composed of an unsegmented tubercle; legs in all stages, after the first, entirely lacking or at the most represented merely by unsegmented tubercles; terminal segments of the abdomen more or less fused into a compound structure, the pygidium, which is more or less set off by an intersegmental constriction, or by some differentiation of the segmental lines, or by dorsal sclerotization, from the preceding abdominal segments. Commonly this pygidium is in some degree dorsally sclerotized and surrounds the anal opening, though ventrally it is but partly sclerotized and bears the vulva. Tubular ducts are almost always present, although at times few and very minute; these in part, at least, are truncate at their inner extremity and with this extremity always symmetrical, there being a median, filamentous prolongation. Disc pores of a more or less quinquelocular type are normally present only in association with the spiracles and the vulva, if at all. The pygidium commonly bears marginal lobes and unsclerotized processes in the form of fringed plates or of gland spines. In habit, the adult female is normally covered by a scale which

is formed from two exuviae and secretionary material, although at times the adult female is retained within the exuvia of the preceding stage.

The Patterns of the Subfamilies and Tribes

The view is here held that the division of the family into subfamilies can be at the present time but a preliminary arrangement. We know only a very small proportion of the species that must actually exist and concerning these we do not know all that we should. We lack essential information about the males and the first stage. Therefore, the arrangement here adopted will be changed as knowledge increases.

There are here adopted two subfamilies, Phoenicococcinae and Diaspidinae.

Subfamily PHOENICOCOCCINAE

Unfortunately, the nomenclatorial type of this subfamily is the most extreme member of the group, a species that can be included in the Diaspididae at all only because in certain stages it carries a suggestion of relationship to other species that can be related to the Diaspididae.

This subfamily includes forms which, with the exception of two known species, conform to the family pattern very nicely except that the pygidium contains no segments anterior to the sixth, and in one example none anterior to the eighth. In all but one species the adult female is enclosed within the sclerotized second exuvia, and in some instances one or even two larval stages are also thus enclosed. In the majority of the species the second stage terminates posteriorly in a flattened plate which surrounds the anus and forms an operculum but in some there is merely a sclerotized, pygidiumlike structure at the end of the body. In none of the known species are there plates or pygidial lobes. Such ducts as are present seem to have the inner extremity forming an 8-shaped figure in cross section. In none are grouped perivulvar pores present, the pores which seem to correspond functionally to the perivulvar pores being in all known cases arranged in a row, both dorsally and ventrally, on the apparent seventh segment. The first-stage larvae are of the general character found in the typical Diaspididae, the antennae showing the same modifications of the terminal segment. In a few forms the first stage bears two pairs of long setae at the caudal end of the body, these being one of the features that seem to relate the more aberrant species to those of more typical form.

Two genera, each now represented by a single species, which can be related to the Diaspididae and to this subfamily only through their broad general characteristics and through the first-stage larvae, are the North American genera *Phoenicococcus* Cockerell and *Canceraspis* Hempel. In neither of these is anything that can be called a formed pygidium, but the character of the antennae, the first-stage larvae, and the type of ducts indicate their connection with other members of the subfamily. In *Canceraspis* not only the adult female but two larval stages as well are contained within the second exuvia. In *Phoenicococcus* the adult female is free, and no scale or covering of any kind is formed.

The subfamily, as here understood, now contains but eighteen known species for the entire world, all of which, except four that belong to the genus *Ancepaspis*, are palm-infesting. For North America it contains but eight known species.

Although it is evident, even from the few species known, that this subfamily contains a considerable diversity of form, it does not seem practicable at the present time to attempt any division into tribes. Such action may very well wait until we have a much larger body of knowledge than is now available.

Subfamily DIASPIDINAE

These are the forms that are preëminently the "scale insects." This is the group that has long been recognized as the subfamily Diaspi(di)nae of the family Coccidae. It is on the whole an extremely homogeneous group, only one species, of those here referred to it, departing so widely from normal character as to cause any difficulty in its assignment.

The characteristics of this subfamily are those of the family as a whole, with the single exception of one species in which no pygidium is formed. The pygidium comprises the segments of the abdomen posterior to, or in some cases even including, the fourth. In the great majority of species, gland spines or plates are present, and in the vast majority, macroducts occur at least in the second stage. In practically all the species a scale composed of the first and second exuviae and of a certain amount of secretionary material is formed by the female. In many, the adult female may be contained within the sclerotized exuvia of

the second stage, but this exuvia practically always shows plates or lobes or macroducts.

Tribes of the Diaspidinae

In this study four tribes are recognized under the Diaspidinae, about which there is occasion for some doubt.

One tribe, Odonaspidini, perhaps should not be recognized, its members being distributed through the two remaining tribes, Diaspidini and Aspidiotini. These last two tribes, however, are very definite groups and between them contain the great majority of the Diaspididae of the world.

Tribe DIASPIDINI

Type.—The genus *Diaspis* Bouché.

The basic pattern of this tribe is sharply marked. Normally there are present, at least in the second stage, macroducts that are clearly of the two-barred type. Normally the members of the second pair of pygidial lobes are divided into two or more or less distinct lobules. Normally there are present merely gland spines rather than fringed plates. Normally disc pores are associated with with the anterior spiracles. The first-stage larvae frequently bear a pair of macroducts on the head. The antennae of the first stage may be either five-or six-segmented, and the terminal segment may be short and nonannulate or elongate and annulate. The antennae of the adult female commonly possess two or more terminal setae. The scale of the female is very frequently elongate; that of the male almost always so. Exuviation usually occurs by the rupturing and pushing back of the ventral derm; this ventral derm remaining membranous.

Departures from this pattern may occur in various ways. The macroducts may be reduced in size to the point where their character cannot readily be distinguished or perhaps at times they may be entirely lost in the adult female, although normally the second stage will possess them. The pygidial lobes may be entirely lost. The median lobes may fuse completely, producing a single median lobe. The division of the second lobes into two lobules may be so greatly obscured that the outer lobule is a mere point, or in some genera there may be no evidence at all of such a division. The gland spines and gland tubercles may entirely disappear. Fringed plates may be present in a relatively few forms. Disc pores are at times not present in association with the anterior spiracles. The antennae of the adult female may possess but one seta. The scale of the female may be circular. But practically always one or more of the normal characteristics, especially the two-barred ducts, will remain.

Tribe ASPIDIOTINI

Type.—The genus *Aspidiotus* Bouché.

The basic pattern of this tribe likewise is sharply marked. Normally there are present, at least in the second stage, macroducts which are long and slender and of the one-barred type. The members of the second pair of pygidial lobes are always without any trace of a division into two lobules. Fringed plates are almost always to be detected, although at times they may be very small. Normally there are no disc pores in association with the anterior spiracles. The antennae of the adult female seem never to have more than one seta, and the antennae of the first stage invariably have the terminal segment elongate and annulate. The pygidium of the adult female very commonly possesses marginal sclerotizations or paraphyses arising from the bases of the lobes or in the interlobular intervals. The body is normally turbinate and very rarely long and slender. The scale of the adult female is with but few exceptions circular or oval, whereas the scale of the male is commonly oval or circular with the exuvia central or subcentral. In many cases the ventral part of the second exuvia of the female splits away from the dorsal part and is incorporated in the ventral scale. The first-stage larva never possesses a pair of macroducts on the head.

Departures from this normal type may occur in many ways. The macroducts may be so greatly reduced in size that their structure becomes indeterminable. The plates may be completely lost or reduced to mere points simulating gland spines. The lobes may be completely lost, or the median lobes may at times be fused into a single lobe. In a few species there may be groups of disc pores associated with the anterior spiracles. Paraphyses are by no means always present. The scale may be long and slender. But in all species thus far examined some one or more of the characteristics indicated have been present.

Tribe ODONASPIDINI

Type.—The genus *Odonaspis* Cockerell.

It is in regard to this tribe that the greatest doubt exists in my mind. The species of the typical genus seem to fit properly into neither the Diaspidini nor the Aspidiotini, yet there are other species which seem to have an affinity with these typical forms but seem to belong to one or the other of the two tribes. However, if the tribe is not recognized we are left with the problem of assignment of species that do not seem to belong properly either to the Aspidiotini or the Diaspidini. For the present, then, Odonaspidini is recognized. The total number of species referable to it is not great, and the number of those which make difficulty is very small.

The complete picture of the tribe is presented by a species having the following characters: neither gland spines nor plates; lobes entirely lacking except for a median lobe which is sometimes indicated; macroducts always very abundant over the dorsum of the pygidium and in lateral areas of the prepygidial abdominal segments and even on the ventral side of the pygidium. The ducts are usually small, moderately broad, and short, and when they are large enough to permit interpretation seem to be somewhat of the two-barred type. Anterior spiracles are associated with disc pores. Antennae of the first-stage larva with the terminal segment are short, at times somewhat annulate, at others not at all so. Exuviation of the second-stage female occurs by the splitting of the derm around the margin, the dorsal part becoming incorporated in the dorsal scale and the ventral part in the ventral scale, both parts being strongly sclerotized.

The scales of the females are usually very thick and entirely enclose the adult insect both dorsally and ventrally. They may be circular or oval, or occasionally long and slender. The scale of the male is normally elongate, with the exuvia terminal.

The difficulties with this tribe arise in connection with some forms which resemble *Odonaspis* in the absence of pygidial lobes and in the abundance and distribution of macroducts, but which in other characteristics strongly suggest forms that are definitely referable to one of the other two principal subfamilies. There is, for example, difficulty with the genera *Rugaspidiotus* and *Rhizaspidiotus*. In the latter, however, distinct median lobes are present, and consequently it is placed in the Aspidiotini.

SYSTEMATICS

Key to Subfamilies of Diaspididae
(Modified from Ferris)

Adult female with anal opening apparently ventral and far removed from apex of body; anal ring very small, distinctly sclerotized; margins of abdominal segments not lobed at any stage . . . . . Phoenicococcinae (p. 167)

Adult female with anal opening ventral, unsclerotized, and subapical; lateral margins of at least the last three abdominal segments strongly lobed. . . . . Diaspidinae (p. 21)

Subfamily PHOENICOCOCCINAE

Genus *Phoenicococcus* Cockerell

In California this genus includes only one species, *Phoenicococcus marlatti* Cockerell, associated with date palm and other species of the genus *Phoenix* . . . . . (p. 167)

Key to the Tribes of Subfamily Diaspidinae
(Modified from Ferris)

1. Adult female without plates or segmentally arranged gland spines, without paired lobes but commonly with single median lobe; macroducts usually small and short, numerous, never in segmentally arranged rows, usually abundant on ventral side of pygidium as well as on dorsum; second exuvia bivalve . . . . . Odonaspidini (p. 163)

   Adult female normally with plates or gland spines, or second stage presenting them; macroducts commonly showing some evidence of arrangement in segmental rows or series; pygidial lobes usually present, median lobes rarely united into single lobe, otherwise various . . 2

2(1). Macroducts of two-barred type; second pygidial lobes usually showing some evidence of being bilobulate; gland spines normally present, although in some forms replaced by fringed plates, in latter case usually with gland tubercles; anterior spiracles commonly with

associated disc pores; antennae of adult female commonly with two or more setae . . . . . Diaspidini (p. 27)
Macroducts of one-barred type, second pygidial lobes never bilobulate; fringed plates normally present; gland tubercles rarely or never present; anterior spiracles normally without associated disc pores; antennae of adult female rarely with more than one seta . . . . . Aspidiotini (p. 22)

Key to Genera of the Tribe Aspidiotini
(Modified from Ferris)

1. Adult female with six groups of perivulvar pores; without plates, lobes or paraphyses; associated with palms . . . . . *Comstockiella* (p. 59)
Adult female with never more than five groups of perivulvar pores; lobes and plates normally present, if lacking, paraphyses are present 2

2(1). Second exuvia larger than and enveloping, although not entirely enclosing, the adult female stage, the latter with lobes and plates very much reduced. . . . . *Aonidia* (p. 37)
Second exuvia smaller than and not at all enveloping adult female 3

3(2). Pygidium with paraphyses arising from bases of lobes or at site of obsolete lobes (other than a mere prolongation of base of median lobes, and other than a mere sclerotization of folds about a pore or pore furrow), these sometimes very small but usually clearly recognizable. 4
Pygidium without such paraphyses or scleroses (other than modifications noted above) 13

4(3). Paraphyses arising only from basal angles of lobes, never from within space between the lobes, thus forming merely paired supports for lateral margins of intersegmental poriferous furrows . 5
With at least one paraphysis arising from about the center of at least one interlobular space, ordinarily that between second and third lobes, frequently with paraphyses along margin beyond third lobe 8

5(4). Mesal paraphysis of first space, in its most typical form, elongate, slender, and terminating apically in a heavily sclerotized knob, some other paraphyses at times showing a similar character; in less typical form first paraphysis may be short and merely apically swollen, the swelling asymmetrical and directed toward the meson. . *Clavaspis* (p. 57)
Mesal paraphysis of first space without apical knob, although increasing in size toward apex 6

6(5). Median and second lobes well developed, sclerotized, apically rounded, their axes somewhat diagonal, so that lobes seem to converge slightly . . . . . *Quadraspidiotus* (p. 79)
Median lobes, and second lobes when present, with their axes parallel . . . 7

7(6). Second lobe never developed more than mere point; anal opening normally small and well toward apex of pygidium, although at times larger; plates usually small, at times scarcely developed . . . . . *Diaspidiotus* (p. 59)
Second lobe usually and third lobe at times developed, although in some species neither more than a point; anal opening usually conspicuously large; plates usually well developed and at times quite extravagantly so; one species without lobes and with plates very small, but with very large anal opening . . . . . *Hemiberlesia* (p. 65)

8(4). Prosoma of mature adult female much swollen and strongly sclerotized, varying in form from slightly reniform to markedly so, lateral prosomatic lobes more or less enclosing pygidium . . . . . *Aonidiella* (p. 39)
Prosoma of mature adult female if sclerotized or swollen, not reniform . . 9

9(8). Pygidium broad at base, elongate and tapering to quite an acute apex, lateral margins tending to be slightly concave; three pairs of very small lobes present; plates confined to interlobular spaces, all extremely small; margin for some distance beyond site of fourth lobe slightly sclerotized and with small paraphyses. . . . *Acutaspis* (p. 37)
Pygidium usually rather short and broad, not tapering to an acute apex; pygidial

lobes and plates usually well developed 10

10(9). Pygidium with conspicuous, branched plates between third and fourth lobes, these exceeding the lobes in length; fourth lobe present as a sclerotized point; margin beyond fourth lobe tending to be slightly sclerotized but without paraphyses. . *Chrysomphalus* (p. 51)
Pygidial plates extremely small or mere points, not exceeding the lobes in length, or even lacking 11

11(10). Pygidium apically rounded; with three pairs of very small pygidial lobes and with fourth lobe indicated as a mere point; margin beyond fourth lobe with extended series of well-developed, quite long, closely set paraphyses . . . . . *Lindingaspis* (p. 75)
Pygidium variously shaped, not apically rounded; paraphyses beyond fourth lobe usually rather few, at times lacking or weakly developed 12

12(11). Entirely without plates; entirely without paraphyses beyond third lobe; dorsal ducts of pygidium with their orifices for the most part arranged in distinct furrows; dorsum of pygidium without sclerotization pattern . . *Targionia* (p. 87)
With at least a few plates, these at times mere points; usually with at least a few paraphyses beyond third lobe; dorsal sclerotization of pygidium arranged in definite pattern . *Melanaspis* (p. 77)

13(3). Body at maturity swollen and strongly sclerotized, pygidium retracted into apex of this sclerotization . . . . . *Nuculaspis* (p. 77)
Body at maturity not swollen, sclerotization various; pygidium always exserted 14

14(13). Third pygidial lobe in form of acute, elongate, sclerotized spine; body with some degree of constriction between mesothorax and metathorax . *Selenaspidus* (p. 83)
Third pygidial lobe variously shaped, not acute; without constriction between mesothorax and metathorax . . . 15

15(14). Pygidium with median and second lobes fused, forming a produced median lobe . . . . . *Chortinaspis* (p. 51)
Pygidium with median and second lobes distinct 16

16(15). Median pygidial lobes present and distinctly differentiated; remainder of pygidial margin crenulate; second and third lobes represented at most by slightly more prominent crenulations; ducts numerous on dorsum and marginal ventral areas of pygidium, all small and slender . . . . . *Rhizapidiotus* (p. 83)
Second and third pygidial lobes distinctly differentiated from other processes, if present at all 17

17(16). Three pairs of pygidial lobes definitely developed 18
With but two pairs of pygidial lobes, the third indicated at most merely by slight point. . . . . *Aspidaspis* (p. 43)

18(17). Fourth pygidial lobe indicated by definite, sclerotized point . . . . . *Dynaspidiotus* (p. 65)
Fourth pygidial lobe not in slightest degree developed . *Aspidiotus* (p. 47)

Genus *Acutaspis* Ferris

In California the genus *Acutaspis* Ferris contains but one species, *Acutaspis albopicta* (Cockerell), which has been found infesting *Philodendron* in a few nurseries. . . . . (p. 37)

Key to the Species of Genus *Aonidia* Targioni

Adult female with pygidial plates present; dorsal macroducts quite large and long; commonly associated with *Juniperus*, *Sequoia*, and other coniferous hosts. . . . . *shastae* (Coleman) (p. 39)
Adult female without pygidial plates; dorsal macroducts very small and slender; associated with *Laurus*. . . . . *lauri* (Bouché) (p. 37)

Key to the Species of Genus *Aonidiella* Berlese and Leonardi (Modified from McKenzie)

1. Ventral prevulvar apophyses present on pygidium; median pygidial lobes largest, second and third lobes progressively smaller 2
Ventral prevulvar apophyses absent on pygidium; pygidial lobes all approxi-

mately same size . . . . . *taxus* Leonardi (p. 43)

2(1). Ventral prevulvar scleroses and apophyses present on pygidium, apophyses at times appearing as scleroses . . . . . *aurantii* (Maskell) (p. 39)
Ventral prevulvar apophyses alone present on pygidium . . . . . *citrina* (Coquillett) (p. 41)

Key to the Species of Genus *Aspidaspis* Ferris

1. With many macroducts present in submarginal zone from pygidium to first abdominal segment; associated with *Arctostaphylos* in California . . . . . *arctostaphyli* (Cockerell and Robbins) (p. 43)
With a few macroducts present anterior to pygidium, these either confined to fourth segment or to a marginal row . . . 2

2(1). Prosoma sclerotized at maturity; associated with pines in California . . . . . *florenciae* (Coleman) (p. 45)
Prosoma remaining membranous at maturity 3

3(2). Pygidial margin beyond site of third lobe irregular, with numerous small points; as at present known only on cultivated fig in California . . . . . *braunschvigi* (Rungs) (p. 45)
Pygidial margin without such irregularities; associated with tan oak in California . *densiflorae* (Bremner)(p. 45)

Key to the Species of Genus *Aspidiotus* Bouché

1. Median pygidial lobes each with a broad basal sclerosis extending into pygidium 2
Median pygidial lobes without such a basal sclerosis . . . . . *destructor* Signoret (p. 47)

2(1). Anal opening very small, close to basal scleroses of median lobes; tubular ducts of pygidium slender, but relatively short . . . . . *spinosus* Comstock (p. 49)
Anal opening larger and three or four times its own diameter removed from basal scleroses of median lobes; tubular ducts of pygidium conspicuously short and stout. . . *hederae* (Vallot) (p. 47)

Genus *Chortinaspis* Ferris

In California the genus *Chortinaspis* Ferris contains but one species, *Chortinaspis consolidata* Ferris, which is associated with various species of *Hilaria* (grass) . . . . . (p. 51)

Key to the Species of Genus *Chrysomphalus* Ashmead
(Modified from McKenzie)

1. At least one prepygidial abdominal segment with submarginal, dorsal cluster of macroducts; first two pygidial plates anterior to third lobe variously fringed 2
Prepygidial abdominal segments with at most three or four marginal ducts, without submarginal, dorsal cluster; first two pygidial plates anterior to third lobe clavate . . . . . *dictyospermi* (Morgan) (p. 53)

2(1). Abdominal segment two only with dorsal submarginal cluster of macroducts . . . . . *ficus* Ashmead (p. 55)
Abdominal segments two and three each with dorsal submarginal cluster of macroducts . . . . . *bifasciculatus* Ferris (p. 51)

Key to the Species of Genus *Clavaspis* MacGillivray

Perivulvar pore groups on pygidium well developed, with at least six pores in any one group . . . . . *disclusa* Ferris (p. 57)
Perivulvar pore groups on pygidium weakly developed, usually with not more than two or three pores in any one group . . . . . *covilleae* (Ferris) (p. 57)

Genus *Comstockiella* Cockerell

Only one species, *Comstockiella sabalis* (Comstock), is found in California. It is associated with palms. Ferris (1942) states that "The genus

is anomalous in any tribe here recognized and perhaps does not belong to the Aspidiotini." . . . . . (p. 59)

Key to the Species of Genus *Diaspidiotus* Berlese and Leonardi

1. Perivulvar pores present 2
   Perivulvar pores lacking 6

2(1). With dorsal submedian clusters of ducts on first pygidial and on prepygidial segments; submarginal ducts conspicuously numerous on pygidium and prepygidial segments; associated especially with *Aesculus*, although occurring on *Populus* and other hosts in California . . . . . *aesculi* (Johnson) (p. 59)
   Entirely without dorsal, submedian ducts on any segments 3

3(2). With definite submarginal rows or series of ducts in anterior lateral angle of the pygidium, that is, on fourth abdominal segment; associated with conifers in California . *ehrhorni* (Coleman) (p. 62)
   Without ducts in this position other than occasionally one or two 4

4(3). Pygidial plates represented merely by minute, simple points; several hosts are attacked although oak appears to be preferred . . . . . *osborni* (Newell and Cockerell) (p. 63)
   Pygidial plates well developed and variously fringed 5

   Median pygidial lobes without plate between; lobes somewhat elongate; associated especially with grape although known from *Betula*, *Crataegus*, *Hicoria*, *Maclura*, and *Platanus* . . . . . *uvae* (Comstock) (p. 63)
   Median pygidial lobes with slender plate between; on many hosts in California . . . . . *ancylus* (Putnam) (p. 61)

6(1). Plates present merely as minute points in interlobular spaces; associated with conifers in California . . . . . *coniferarum* (Cockerell) (p. 62)
   Plates well developed, all of one type, long and laterally toothed, occurring laterad of site of third lobe; associated with *Liquidambar* in California . . . . . *liquidambaris* (Kotinsky) (p. 62)

Genus *Dynaspidiotus* Thiem and Gerneck

This genus includes but one California species, *Dynaspidiotus britannicus* (Newstead), which is associated with *Berberis*, *Ilex*, and *Ruscus*. . . . . (p. 65)

Key to the Species of Genus *Hemiberlesia* Cockerell

1. Perivulvar pores present 2
   Perivulvar pores lacking 7

2(1). Second pygidial lobes lacking or developed merely as unsclerotized points . . 3
   Second pygidial lobes definitely developed, sclerotized 4

3(2). Pygidial plates small and inconspicuous, confined to first and second interlobular spaces; dorsal pygidial macroducts very numerous, in distinct furrows on fifth and sixth segments, anal opening large and quite close to apex of pygidium; associated with willow and poplar in California *popularum* (Marlatt) (p. 73)
   Pygidial plates well developed, forming a quite definite fringe, present laterad of site of third lobe; dorsal pygidial macroducts relatively few . . . . . *lataniae* (Signoret) (p. 69)

4(2). With three pairs of pygidial lobes present, the third indicated at least by a sclerotized point 5
   With but two pairs of pygidial lobes present, the second normally shorter than median, site of third being occupied by unsclerotized point or platelike process . . . . . *howardi* (Cockerell) (p. 69)

5(4). Dorsal submarginal groups of macroducts present on fourth and preceding abdominal segments; anal opening with diameter slightly less than length of median lobes and removed by about three times this diameter from base of these lobes . 6
   Dorsal submarginal macroducts not present anterior to fifth segment; anal opening relatively large, being approximately equal in diameter to length of median lobes 8

6(5). Anterior groups of perivulvar pores of pygidium composed of from seven to ten pores each; occasionally single anterior

median pore present; associated with *Fraxinus velutina* in California . . . . . *fraxini* McKenzie (p. 69)

Anterior groups of perivulvar pores of pygidium composed of only two or three pores each, anterior median pore lacking; associated especially with *Camellia* and related hosts in California . . . . . *degenerata* (Leonardi) (p. 67)

7(1). Plates of pygidium reduced to minute points, present only in median and first interlobular spaces; median and second pygidial lobes well developed, but broad and low; associated with oaks in California . . *quercicola* Ferris (p. 73)

Plates of pygidium developed, fringed, present laterad of third lobe; second pygidial lobe forming merely a simple, sclerotized point . . . . . *rapax* (Comstock) (p. 73)

8(5). Second pygidial lobe pointed and unsclerotized; scale of adult female broadly oval, males not present . . . . . *palmae* (Cockerell) (p. 71)

Second pygidial lobes similar in form to median lobes, sclerotized; scale of adult female elongate oval, males present . . *cyanophylli* (Signoret) (p. 65)

Genus *Lindingaspis* MacGillivray

Only one species, *Lindingaspis rossi* (Maskell), is known in California where it is most commonly associated with *Auracaria* spp. . . . (p. 75)

Genus *Melanaspis* Cockerell

This genus contains but one California species[3], *Melanaspis obscura* (Comstock), which was present at one time in this state where it was associated with *Hicoria pecan*. It was first discovered in 1933 and was later eradicated. Since 1941 no specimens have been found. . . . . (p. 77)

Genus *Nuculaspis* Ferris

Only one species, *Nuculaspis californica* (Coleman) is known in California where it commonly infests species of *Pinus* and *Pseudotsuga taxifolia* . . . . . (p. 77)

Key to the Species of Genus *Quadraspidiotus* MacGillivray

1. Perivulvar pores present 2

Perivulvar pores lacking . . . . . *perniciosus* (Comstock) (p. 81)

2(1). At full maturity with derm of entire dorsum quite heavily sclerotized; with pronounced constriction between prothorax and mesothorax as well as between mesothorax and metathorax; third pygidial lobe indicated at least by a point . . *juglans-regiae* (Comstock) (p. 81)

At full maturity with the derm remaining membranous; prosoma without constrictions; third pygidial lobe not indicated . . . . . *forbesi* (Johnson) (p. 79)

Genus *Rhizapidiotus* MacGillivray

In California the genus *Rhizaspidiotus* contains but one species, *Rhizaspidiotus dearnessi* (Cockerell), which is found especially on Compositae. . . . . (p. 83)

Key to the Species of Genus *Selenaspidus* Cockerell

1. Perivulvar pores present . . . . . *articulatus* (Morgan) (p. 85)

Perivulvar pores lacking 2

2(1). Median and second pygidial lobes approximately same size and shape, smoothly rounded; ventral sclerotized prosomal spur present . *albus* McKenzie (p. 83)

Second pair of pygidial lobes noticeably smaller than median lobes, both pairs notched on either side; ventral sclerotized prosomal spur lacking, submarginal sclerotized boss present in this position . . . . . *rubidus* McKenzie (p. 85)

Genus *Targionia* Signoret

Only one species, *Targionia bigeloviae* (Cockerell), is known, as established in California. . . . . (p. 87)

[3]*Melanaspis lilacina* (Cockerell) also occurs in California. It differs from *Melanaspis obscura* (Comstock) in lacking perivulvar pores, these structures present in the later species. (See p. 77.)

Key to the Genera of Tribe Diaspidini (Modified from Ferris)

1. Adult female entirely enclosed within exuvia of preceding stage 2
Adult female not enclosed within exuvia of preceding stage; in a few forms this exuvia is unusually large and may more or less envelop the female but does not enclose it 4

Pupillarial Forms

2(1). Adult female with disc pores present on at least one segment anterior to and in addition to usual perivulvar pores; form elongate and slender; second stage with well-developed lobes and large macroducts . . . . *Leucaspis* (p. 129)
Adult female without disc pores other than usual perivulvar groups or a transverse row anterior to vulva or with all such pores lacking 3

3(2). Adult female with median lobes forming notch in apex of pygidium and yoked together basally; antennae tending to be elongate conical and close together at apex of head, at times with membranous process between . . *Fiorinia* (p. 111)
Adult female with prominent median lobes without scleroses, thus not yoked together basally; antennae much reduced, appearing rounded, without membranous process between . . . . . *Xerophilaspis* (p. 163)

Nonpupillarial Forms

4(1). Pygidium with single median pygidial lobe which shows no trace of division; marginal pygidial macroducts each with swollen, sclerotic rim about orifice; as now known occurring only on oaks . . . . . *Quernaspis* (p. 155)
Median pygidial lobes, if present, sometimes fused at base but always with some indication of their paired character; at times lacking 5

5(4). Median pygidial lobes present, yoked basally by an internal sclerosis . . 6
Median pygidial lobes present or absent, if present not yoked basally by internal sclerosis (their separation is sometimes obscured by crowding or by secondary sclerotization but is definitely determinable by careful examination) . . 10

Median lobes yoked basally

6(5). Prosoma swollen, more or less quadrate, wider than the postsoma, the sides of the latter roughly parallel; pygidial lobes forming distinct notch in apex of pygidium . . . . . *Aulacaspis* (p. 89)
Body turbinate or elongate 7

7(6). Body broadly turbinate; median lobes of pygidium large and prominent . . . . . *Pseudaulacaspis* (p. 153)
Body fusiform, prosoma tapering anteriorly; median lobes various 8

8(7). Median pygidial lobes actually separate, but their mesal margins very tightly appressed; pygidial and prepygidial macroducts confined to margin and to a few in submarginal series . . . . . *Pinnaspis* (p. 150)
Median pygidial lobes usually distinctly separate or divergent for at least part of their length, although at times fused basally and with merely an apical notch; if appressed mesally dorsal macroducts are abundant in both submarginal and submedian series on fifth and preceding segments 9

9(8). Median pygidial lobes with free inner margin longer than free outer margin, inverted V- or U-shaped notch being formed in apex of pygidium; usually lobes are strongly divergent . . . . . *Phenacaspis* (p. 147)
Median pygidial lobes with free outer margin usually as long as or even longer than free inner margin, lobes tending to project from body for their whole length and thus not forming a median apical notch in pygidium. . . . . *Chionaspis* (p. 93)

Median lobes not basally yoked

10(5). Median pygidial lobes very small and obscure, much exceeded in size by second

lobes; as known, occurring on Cupressaceae . . . . . *Lineaspis* (p. 133)
Median pygidial lobes present or absent, if present always larger than or at least equal to second lobes 11

11(10). Marginal pygidial macroducts with axis of their orifices set transversely or essentially so, each with orifice surrounded by a transversely oval, sclerotized rim 12
Marginal pygidial macroducts with axis of their orifices set longitudinally or diagonally, sclerotized rim, if present, similarly disposed 13

12(11). At least three pairs of pygidial lobes present; gland spines broad, apically fimbriate or laterally serrate . . . . . *Parlatoria* (p. 137)
With but two pairs of pygidial lobes present; gland spines few, small, not fimbriate or serrate; oral scleroses of first two pairs of marginal pygidial macroducts asymmetrically swollen. . . . . *Parlatoreopsis* (p. 137)

13(11). Body slenderly fusiform and membranous at maturity 14
Body broadly turbinate or pyriform, either strongly sclerotized or membranous at maturity. 15

14(13). Pygidium tapering abruptly, acute; mesal margins of median pygidial lobes contiguous but not fused . . . . . *Neopinnaspis* (p. 133)
Pygidium broad; median pygidial lobes various but without mesal margins contiguous 16

15(13). With elongate, club-shaped, internal, sclerotized process arising from base of each median pygidial lobe; dorsum of prosoma strongly sclerotized as far posteriorly as first abdominal segment . . . . . *Howardia* (p. 115)
Without elongate, club-shaped, internal sclerotized process arising from base of each median pygidial lobe; prosoma membranous . . . . . *Pseudoparlatoria* (p. 155)

16(14). Margin of pygidium with membranous, low broad, apically serrate processes in addition to lobes and gland spines; occurring, as far as known, only on bamboos . . . . . *Kuwanaspis* (p. 115)
Margin of pygidium with variously shaped (generally quite elongated) processes including gland spines or fringed plates 17

17(16). Body elongate and fusiform or elongate oval, not widening anteriorly, length normally at least twice the greatest breadth, and greatest breadth not across the head or prothoracic region . . 18
Body turbinate or pyriform or with prosoma laterally expanded, length not likely to be more than twice the greatest breadth, greatest breadth across head or prothoracic region 24

18(17). Perivulvar pores present, although at times very few 19
Perivulvar pores lacking (in one species occasionally present) 22

Body elongate, perivulvar pores present

19(18). Three pairs of pygidial lobes present, third pair distinct, flattened, in size and form resembling second pair; dorsal pygidial ducts scattered irregularly, present to seventh or perhaps eighth segment . . . . . *Unaspis* (p. 159)
Third pygidial lobes represented only by variously shaped, sclerotized point or points, at times lacking 20

20(19). Median lobes of pygidium apically rounded, tending to be elongate and narrow, never laterally notched; gland spines never present between them; dorsal ducts tending to be only slightly smaller than the marginal and to be arranged in distinct segmental rows; submarginal setae on ventral side of pygidium tending to be enlarged; all species now known are grass-infesting . . . . . *Duplachionaspis* (p. 109)
Median lobes of pygidium usually quite broad and heavy, but even if narrow they are notched laterally and are apically truncate or irregular and usually there is a pair of gland spines between them; dorsal ducts various. 21

21(20). Dorsal pygidial macroducts, even if few, arranged in definite segmental rows or series, none present posterior to sixth segment (except single duct on seventh and eighth in one species); eyes and

antennae without unusual developments; second pygidial lobes always present, well developed, flattened, and bilobed . . . . . *Lepidosaphes* (p. 117)

Dorsal pygidial macroducts, distributed irregularly, frequently present to seventh or even eighth segment; eyes or antennae at times with some unusual feature; second pygidial lobe various, at times reduced to mere point or heavily sclerotized and but slightly bilobed . . . . . *Aonidomytilus* (p. 87)

Body elongate, perivulvar pores lacking

22(18). Three pairs of well-developed pygidial lobes present, third pair deeply bilobed and resembling second in size and form . . . . . *Stramenaspis* (p. 159)

Third pygidial lobes, if recognizable at all, not bilobed 23

23(22). Third pygidial lobe present, flattened, resembling first lobule of second lobe in size and form; no marginal macroducts in pairs . . . . *Pallulaspis* (p. 135)

Third pygidial lobe, if recognizable at all, merely a sclerotized point; some of marginal macroducts arranged in pairs . . . . . *Nilotaspis* (p. 135)

24(17). Perivulvar pores present 25

Perivulvar pores lacking (occasionally present in one species but are individually vestigial, being scarcely larger than seta bases) 29

Body pyriform or turbinate, perivulvar pores present

25(24). Pygidium entirely without large marginal macroducts and none of marginal ducts arranged in normal fixed positions . . . . . *Protodiaspis* (p. 153)

Pygidium with large marginal macroducts in normal fixed positions 26

26(25). Dorsal pygidial macroducts arranged in definite, segmental rows, not present posterior to fifth segment except for single submarginal duct anterior to second lobe; known in North America only from conifers of family Cupressaceae . . . . *Carulaspis* (p. 91)

Dorsal pygidial macroducts at times exceedingly few or almost lacking, not in definite segmental rows; when in sufficient numbers to define arrangement, usually scattered or in clusters except for rows on prepygidial segments; present to sixth or seventh segment . . 27

27(26). Basal scleroses of dorsal marginal setae of at least segments six and seven (second and third lobes) definitely enlarged, usually quite strikingly so; median lobes usually close together or even basally approximate or fused, never apically divergent; second lobes tending to be reduced, sometimes almost obsolete; third lobe never developed as more than minute point. 28

Basal scleroses of these setae not enlarged; median lobes well separated or in many species apically divergent and forming apical notch in pygidium; second lobes tending to be well developed and even third lobe present at times . . . . . *Diaspis* (p. 103)

28(27). Perivulvar pores in four or five well-developed groups . *Epidiaspis* (p. 109)

Perivulvar pores vestigial, or if definitely present with not more than four or five on either side (one species, in which the perivulvar pores may be either present or absent, belonging to the genus). . . . . *Situlaspis* (p. 155)

Body pyriform or turbinate or with expanded prosoma, perivulvar pores lacking

29(24). Median lobes forming notch in apex of pygidium, widely separated, and with a pair of apically fimbriate gland spines between; known only from cycads . . . . . *Furchadiaspis* (p. 113)

Median lobes if present at all, forming apical notch in pygidium; if present, with not more than a single, reduced, simple gland spine between median lobes . . . . . *Situlaspis* (p. 155)

Generic Keys to Species of Tribe Diaspidini

(Modified from Ferris unless otherwise indicated)

Key to the Species of Genus *Aonidomytilus* Leonardi

1. Perivulvar pores present, although at times very few 2
   Perivulvar pores lacking . . . . . *bilobis* Ferris (p. 87)

2(1). Perivulvar pores extremely few, there being not more than three or four on each side and some of these apparently being on second segment anterior to vulva; dorsal pygidial ducts numerous, of various sizes, for most part with sclerotized area around orifice; median lobes short, apically almost truncate, second lobes mere points; occurring as far as known only on *Sambucus* and *Catalpa* . . . . . *variabilis* Ferris (p. 89)
   Perivulvar pores in the usual four or five groups 3

3(2). All gland spines exceedingly minute, third lobes lacking, second and median lobes very short; occurring principally on *Ceanothus* in California . . . . . *ceanothi* Ferris (p. 87)
   Gland spines of the pygidium well developed; occurring especially on the chenopodiaceous genus *Atriplex* . . . . . *concolor* (Cockerell) (p. 89)

Genus *Aulacaspis* Cockerell

The genus *Aulacaspis* Cockerell contains but one species, *Aulacaspis rosae* (Bouché) in California, infesting rose and closely related hosts. (p. 89)

Genus *Carulaspis*, MacGillivray

This genus includes but one species[4], *Carulaspis visci* (Schrank), in California where it is commonly associated only with hosts of the coniferous family Cupressaceae . . . . . (p. 91)

Key to the Species of Genus *Chionaspis* Signoret

1. Median lobes of pygidium closely appressed throughout their entire length, their mesal margins straight, their outer margins twice notched; occurring as far as known only on hosts of the family Ulmaceae . . *americana* Johnson (p. 93)
   Median lobes of pygidium with mesal margins not thus appressed, divergent at apex even if fused for part of their length 2

2(1). Median pygidial lobes noticeably elongate, narrowly rounded apically, mesally divergent, their entire margin, mesally and laterally, minutely serrate, never deeply notched, separate completely to base . . . . . *wistariae* Cooley (p. 101)
   Median pygidial lobes short and rounded, or laterally notched or partly fused . 3

3(2). Dorsal pygidial macroducts few, normally not more than two or three large ducts in any submedian group, or with submedian groups anterior to segment five lacking or composed only of small ducts; submedian group of sixth segment lacking; submarginal group of fifth segment with but three or four ducts . . . 4
   Dorsal pygidial macroducts more numerous, submedian group of segment six present and with at least two pores, submedian groups with large ducts present on segments five to three and containing four or more large ducts; submarginal group of segment five with at least four or five ducts, usually more 5

4(3). Median lobes low, rounded, normally not notched laterally, or if so only slightly; median zygosis elongate and slender; occurring on hosts related to apple . . . . . *furfura* (Fitch) (p. 97)
   Median lobes laterally notched and somewhat acute; median zygosis short and broad or weakly developed; known at present only from *Gleditsia* (honey or sweet locust) . . . . . *gleditsiae* Sanders (p. 99)

5(3). Median pygidial lobes with mesal margins straight, broadly divergent and somewhat longer than free outer margin; associated with genus *Cornus* . . . . . *corni* Cooley (p. 93)
   Median pygidial lobes acute or rounded, mesal and lateral margins approximately equal 6

6(5). Median pygidial lobes laterally notched and apically rounded, well separated; second lobes forming narrow, sclerotized points; gland spines of sixth and seventh segments in pairs members of pairs of equal size; associated with *Tamarix* . . . . . *etrusca* Leonardi (p. 97)

[4]Another species, *Carulaspis minima* Targioni has recently been recognized in California. It is easily differentiated from *Carulaspis visci* (Shrank) by lack of a dorsal pygidial macroduct between the median lobes, this duct present in the latter species. (See p. 91.)

Median pygidial lobes acute or rounded, not laterally notched, gland spines of sixth segments, if paired, with one smaller than the other 7

7(6). Submedian dorsal duct groups of segments three to five with about one-half or more of ducts very small; submedian group of segment six at times composed entirely of small ducts; occurring especially on *Salix* and *Populus* . . . . . *salicis-nigrae* (Walsh) (p. 101)

Submedian dorsal duct groups of segments three to five composed predominantly of large ducts, that of segment six entirely so 8

8(7). Median pygidial lobes approximate mesally; associated with *Salix* and *Ceanothus* and several other host genera along Pacific Coast . . . . . *ortholobis* Comstock (p. 99)

Median pygidial lobes narrowly but distinctly separated; associated with *Ceanothus* and probably other hosts in southern California . . . . . *sassceri* Cockerell and Robbins (p. 101)

Key to the Species of Genus *Diaspis* Costa

1. Median pygidial lobes with their mesal margin scarcely or not at all longer than their free lateral margin, the lobes therefore projecting completely from apex of pygidium and not forming a median emargination or notch . . . . . *echinocacti* (Bouché) (p. 105)

Median pygidial lobes with mesal margin definitely longer than free lateral margin, frequently two or three times as long, lobes usually projecting but little from apex of pygidium and therefore forming a median notch or emargination . . 2

2(1). Pygidium with three or more large ducts in submarginal series extending parallel to margin from just anterior to second lobe or farther . . . . . *bromeliae* (Kerner) (p. 105)

Pygidium without such a submarginal series of large ducts, there being ordinarily not more than two such, one anterior to each of second and third lobes 3

3(2). Submedian dorsal groups of ducts present on at least one segment anterior to fifth abdominal segment 4

Submedian dorsal groups of ducts either entirely lacking or not present anterior to fifth abdominal segment. . . . 5

4(3). Dorsal submedian groups of macroducts present from pygidium to metathorax; associated with *Arctostaphylos* in California . *manzanitae* Whitney (p. 107)

Dorsal submedian groups of macroducts lacking on metathorax, few microducts only in this area; known only on *Phoradendron* in California . . . . . *parasiti* McKenzie (p. 107)

5(3). Prosoma normally with earlike lobe on each side, at times lacking on one side or occasionally on both sides, but usually seen if numerous specimens examined . . . . . *boisduvalii* Signoret (p. 103)

Prosoma always without earlike lobes; apparently associated with coco palm and other palm species . . . . . *cocois* (Lichtenstein) (p. 105)

Genus *Duplachionaspis* MacGillivray

In California this genus contains but one species, *Duplachionaspis spartinae* (Comstock), which is associated with *Spartina* (cord grass). . (p. 109)

Key to the Species of Genus *Epidiaspis* Cockerell

Second pygidial lobes at times small, but definitely present; associated especially with *Salix* and *Populus* in California . . . . . *salicicola* Ferris (p. 111)

Second pygidial lobes entirely lacking or present as merest point; characteristically associated with hosts such as pear and plum . . . . . *leperii* (Signoret) (p. 109)

Key to the Species of Genus *Fiorinia* Targioni

1. Pygidial margin with small macroducts only; with tubular process between antennae . . . *theae* Green (p. 113)

Pygidial margin with at least a few large macroducts; tubular process between antennae lacking 2

2(1). Pygidial margin with from three to six large, and no small macroducts . . 3
Pygidial margin with four or five large macroducts followed by some small ducts; associated with conifers . . . . . *japonica* Kuwana (p. 111)

3(2). Pygidial margin with but three or occasionally four large macroducts; infesting many hosts . . . . . *.fioriniae* (Targioni) (p. 111)
Pygidial margin with five to seven large macroducts; associated with *Podocarpus* spp. . . . *juniperi* Leonardi (p. 113)

Genus *Furchadiaspis* MacGillivray

Only one species, *Furchadiaspis zamiae* (Morgan), associated with various cycads, is found in California . . . . . (p. 113)

Genus *Howardia* Cockerell

In California this genus includes but one species, *Howardia biclavis* (Comstock), a mining scale rarely seen in the state . . . . . (p. 115)

Genus *Kuwanaspis* MacGillivray

One species, *Kuwanaspis pseudoleucaspis* (Kuwana), is found associated in California with bamboo . . . . . (p. 115)

Key to the Species of Genus *Lepidosaphes* Shimer

1. Prepygidial abdominal segments, some at least with distinct secondary lobe or sclerotized spur at each anterior lateral angle 2
Prepygidial abdominal segments entirely without such lobes or spurs . . . 6

2(1). Dorsum at maturity strongly sclerotized from pronotum to first abdominal segment, this sclerotization broken into plates by intersegmental furrows; marginal spurs small, thornlike . . . . . *gloverii* (Packard) (p. 121)
Dorsum at maturity remaining membranous 3

3(2). Eyes forming each a sclerotized, thornlike spur that projects forward from the side of the head; associated with orchids . . . . . *machili* (Maskell) (p. 123)
Eyes unmodified 4

4(3). Dorsal submedian macroduct group on sixth segment containing only one or two ducts; known only from Umbrella pine, *Sciadopitys verticillata* in California . . . . . *.sciadopitysi* McKenzie (p. 125)
Dorsal submedian macroduct group on sixth segment numerous, containing usually as many as fifteen or twenty ducts . 5

5(4). Mesal margin of median pygidial lobes twice-notched; prepygidial abdominal segments one to five with small, sclerotized spot or "boss" on dorsum slightly in from lateral margin on each side . . . . . *chinensis* Chamberlin (p. 119)
Mesal margin of median pygidial lobes once-notched; sclerotized spots or bosses on prepygidial abdominal segments usually absent, if present, only three such structures on each side . . . . . *ulmi* (Linnaeus) (p. 127)

6(1). First, second, and fourth abdominal segments each with a little sclerotized area or boss on dorsum, slightly in from each lateral margin . . . . . *beckii* (Newman) (p. 117)
Entirely without such structures . . 7

7(6). Head at full maturity tending to be slightly sclerotized and projecting laterally in form of a low rounded, posteriorly directed lobe on each side; associated with *Codiaeum* (croton) . . . . . *tokionis* (Kuwana) (p. 127)
Head at full maturity membranous, evenly rounded but without posteriorly directed lobe on each side 8

8(7). At least some of the pygidial gland spines bifid at tip and with two microducts discharging through them; median pygidial lobes somewhat unusually large and prominent, quite close together basally, with two notches on outer margin; second lobes somewhat reduced, forming small, bilobed points; dorsal ducts much smaller than marginal, series on sixth segment reaching from near anus almost

to margin; associated with cultivated fig (occurring on twigs). . . . . *ficus* (Signoret) (p. 121)
Pygidial gland spines simple, not bifid at tip, and with only one microduct discharging through them 9

9(8). Dorsal pygidial macroducts of segment six confined to small row of two, three, or four on each side and quite close to anus 10
Dorsal pygidial macroducts of segment six in extended row, probably representing both submarginal and submedian groups 13

10(9). Pygidium with small submarginal dorsal macroduct located slightly anterior to second lobe; associated with *Dendrobium* orchids . . . *noxia* McKenzie (p. 125)
Pygidium lacking small submarginal dorsal macroduct anterior to second lobe . 11

11(10). Median pygidial lobes with lateral margin serrate; antennae two-spined . . . 12
Median pygidial lobes with lateral margin once-notched; antennae one-spined . . . . . *maskelli* (Cockerell) (p. 123)

12(11). Dorsal pygidial macroducts of segment six confined to row of three or four quite close to anus; third pygidial lobe lacking although margin in this area serrate; associated with *Dendrobium* orchids . . . . . *mackieana* McKenzie (p. 123)
Dorsal pygidial macroducts of segment six confined to either one or a small row of two quite close to anus; third pygidial lobe present, represented only as sclerotized point; associated with olive in California . . . . . *destefanii* Leonardi (p. 119)

13(9). All dorsal ducts of pygidium much smaller than the marginal, none being more than about half the width of larger ducts as measured across apical bar; associated with cultivated fig (occurring on leaves); dimorphic form of. . . . . *ficus* (Signoret) (p. 121)
Larger of dorsal ducts of pygidium about two-thirds the width of marginal ducts as measured across apical bar; associated with *Camellia* and *Thea* . . . . . *camelliae* Hoke (p. 119)

Key to the Species of Genus *Leucaspis* Targioni

Adult female with two pairs of quite large, sclerotized lobes, distinctly differentiated from other marginal processes; body with almost continuous row of gland spines or tubercles from pygidium to head . . . . . *cockerelli* (de Charmoy) (p. 129)
Adult female with pygidial lobes scarcely or not at all differentiated from other pygidial processes except for slightly more pronounced sclerotization; gland tubercles confined to elongate, crowded group near each anterior spiracle; associated with *Podocarpus*. . . . . *portaeaureae* Ferris (p. 129)

Genus *Lineaspis* MacGillivray

In California this genus includes but one species, *Lineaspis cupressi* (Coleman), associated with coniferous hosts such as *Cupressus, Juniperus,* and *Libocedrus* . . . . . (p. 133)

Genus *Neopinnaspis* McKenzie

One species, *Neopinnaspis harperi* McKenzie, an omnivorous form infesting some fifty plant species, is found in California. It shows some preference for *Ceanothus arboreus, Ceratonia siliqua,* and *Prunus Lyoni* . . . . . (p. 133)

Genus *Nilotaspis* Ferris

This genus contains but one species, *Nilotaspis halli* (Green), in California, this associated with hosts such as prune and peach . . . (p. 135)

Genus *Pallulaspis* Ferris

In California this group contains but one species, *Pallulaspis ephedrae* Ferris, associated with *Ephedra* . . . . . (p. 135)

Genus *Parlatoreopsis* Lindinger

Only one species, *Parlatoreopsis chinensis* (Marlatt), is found in California . . . . (p. 137)

Key to the Species of Genus *Parlatoria* Targioni (Modified from McKenzie)

1. With at least a few sclerotized duct tubercles present on anterior prosoma cephalad of abdominal segments 2
   Without sclerotized duct tubercles on anterior prosoma . . . . . *Blanchardii* (Targioni-Tozzetti) (p. 137)

2(1). Pygidium normally with four plates between third lobes (sixth abdominal segment) and position of fourth lobe (fifth abdominal segment) . . . . . *oleae* (Colvée) (p. 141)
   Pygidium with three plates between third and fourth lobes 3

3(2). With small, but distinct, invaginated membranous derm pocket between posterior spiracle and body margin 4
   Without invaginated membranous derm pocket between posterior spiracle and body margin 7

4(3). Eyespot modified to form stout spur projecting from prosoma about opposite mouth parts 5
   Eyespot various, flat, irregular, sometimes almost hemispherical and often so obscure as to appear lacking 6

5(4). Fourth pygidial lobe slender, definitely sclerotized, and almost spurlike . . . . . *crotonis* Douglas (p. 139)
   Fourth pygidial lobe membranous and closely simulating adjacent plates in structure and appearance, although usually much smaller . . . . . *proteus* (Curtis) (p. 145)

6(4). Submarginal dorsal pygidial macroducts ranging in number from twenty to twenty-nine on each side of body; pygidial lobes almost equal in size; perivulvar pores few in number, total range nineteen to thirty-three, average about twenty-six . . . . . *camelliae* (Comstock) (p. 139)
   Submarginal dorsal pygidial macroducts ranging in number from twenty-six to ninety-five (average about fifty-one) on each side of body; pygidial lobes obviously graded, third pair definitely smaller than median pair; perivulvar pores numerous, total range twenty-five to eighty-four with an average of fifty-eight . . . . *theae* Cockerell (p. 147)

7(3). With dorsal intermediate macroducts present above anterior group of perivulvar pores and on abdominal segment anterior to these . . . . . *pittospori* Maskell (p. 143)
   Without dorsal intermediate macroducts above anterior group of perivulvar pores and on abdominal segment anterior to these . *pergandii* Comstock (p. 143)

Key to the Species of Genus *Phenacaspis* Cooley and Cockerell

1. Margin of median pygidial lobes finely serrate 2
   Margin of median pygidial lobes smooth; associated with pines and other Abietaceae in California . . . . . *pinifoliae* (Fitch) (p. 149)

2(1). Mesal paraphysis of median lobes inconspicuous or lacking; associated with *Wistaria* in California . . . . . *fujicola* Kuwana (p. 147)
   Mesal paraphysis of median lobes well developed, strongly arcuate; recorded from several hosts but not on *Wistaria* . . . *sandwicensis* Fullaway (p. 149)

Key to the Species of Genus *Pinnaspis* Cockerell

1. Preanal scars of pygidium usually forming distinct, crescentic sclerotizations . 2
   Preanal scars of pygidium entirely lacking normally 3

2(1). Scale of female white or gray . . . . . *strachani* (Cooley) (p. 151)
   Scale of female definitely brown . . . . . *aspidistrae* (Signoret) (p. 150)

3(1). Median pygidial lobes usually slightly but distinctly separated from each other; fifth abdominal segment normally without any submarginal macroducts; scale of female pale brown, yellow, or white; no males known; an apparently parthenogenetic species . . . . . *buxi* (Bouché) (p. 150)
   Median pygidial lobes always closely appressed together; fifth abdominal segment normally with at least one submarginal macroduct; female scale brown; males, when present, white-felted and tricarinate . . . . . *aspidistrae* (Signoret) (p. 150)

Genus *Protodiaspis* Cockerell

In California this genus contains but one species, *Protodiaspis agrifoliae* Essig, associated with *Quercus agrifolia* . . . . . (p. 153)

Genus *Pseudaulacaspis* MacGillivray

Pseudaulacaspis pentagona (Targioni) is the only species found in California . . . . (p. 153)

Genus *Pseudoparlatoria* Cockerell

Only one species, *Pseudoparlatoria parlatorioides* (Comstock), associated mainly with phoenix palms and cypripedium orchids, is to be found in California nurseries . . . . . (p. 155)

Genus *Quernaspis* Ferris

This genus contains but one species, *Quernaspis quercus* (Comstock), associated with oaks in California . . . . . (p. 155)

Key to the Species of Genus *Situlaspis* MacGillivray

1. Second pygidial lobe present as distinct lobe or point 2
   Second pygidial lobe entirely obsolete; pygidium broadly rounded apically; associated with *Atriplex* in California . . . . . *atriplicis* (Ferris) (p. 155)

2(1). Pygidium and prepygidial segments with large numbers of dorsal macroducts . 3
   Pygidium with scarcely more than ten macroducts, including those of margin, on each side; prepygidial segments with but few small ducts on margins; perivulvar pores at times present; on numerous hosts . . . . . *yuccae* (Cockerell) (p. 157)

3(2). Median pygidial lobes large and broad (each almost twice as large as anal opening circumference), well separated, and with three or four dorsal ducts between their bases; associated with mistletoe in California . . . . . *multipora* (Ferris) (p. 157)
   Median pygidial lobes quite small (each approximately same size as anal opening circumference), and with only one large duct between their bases; associated with *Dalea* in one California county . . . . . *daleae* Ferris (p. 157)

Genus *Stramenaspis* Ferris

This group is represented by only one species, *Stramenaspis kelloggi* (Coleman), associated with conifers of the genera *Abies*, *Pseudotsuga*, and *Pinus* in California . . . . . (p. 159)

Genus *Unaspis* MacGillivray

Only one species, *Unaspis euonymi* (Comstock), is represented in California where it is associated with *Euonymus* . . . . . (p. 159)

Genus *Xerophilaspis* Cockerell

This group contains but one species, *Xerophilaspis prosopidis* (Cockerell), associated with *Prosopis* in California . . . . . (p. 163)

Key to the Genera of Tribe Odonaspidini (Modified from Ferris)

Pygidium with at least one pair and usually with two pairs of marginal scleroses which indicate intersegmental junctures of eighth and seventh and sixth abdominal segments; dorsum of fifth and preceding abdominal segments commonly with well-delimited paratergal areas; characteristically infesting grasses . . . . . *Odonaspis* (p. 163)
Pygidium entirely without such intersegmental scleroses; dorsum of fifth and preceding abdominal segments with paratergal areas weakly or not at all indicated; not infesting grasses . . . . . *Rugaspidiotus* (p. 167)

Key to the Species of Genus *Odonaspis* Leonardi

1. Pygidium with apical cluster of structures resembling gland spines . . . . . *penicillata* (Green) (p. 163)
   Pygidium without such structures . . 2

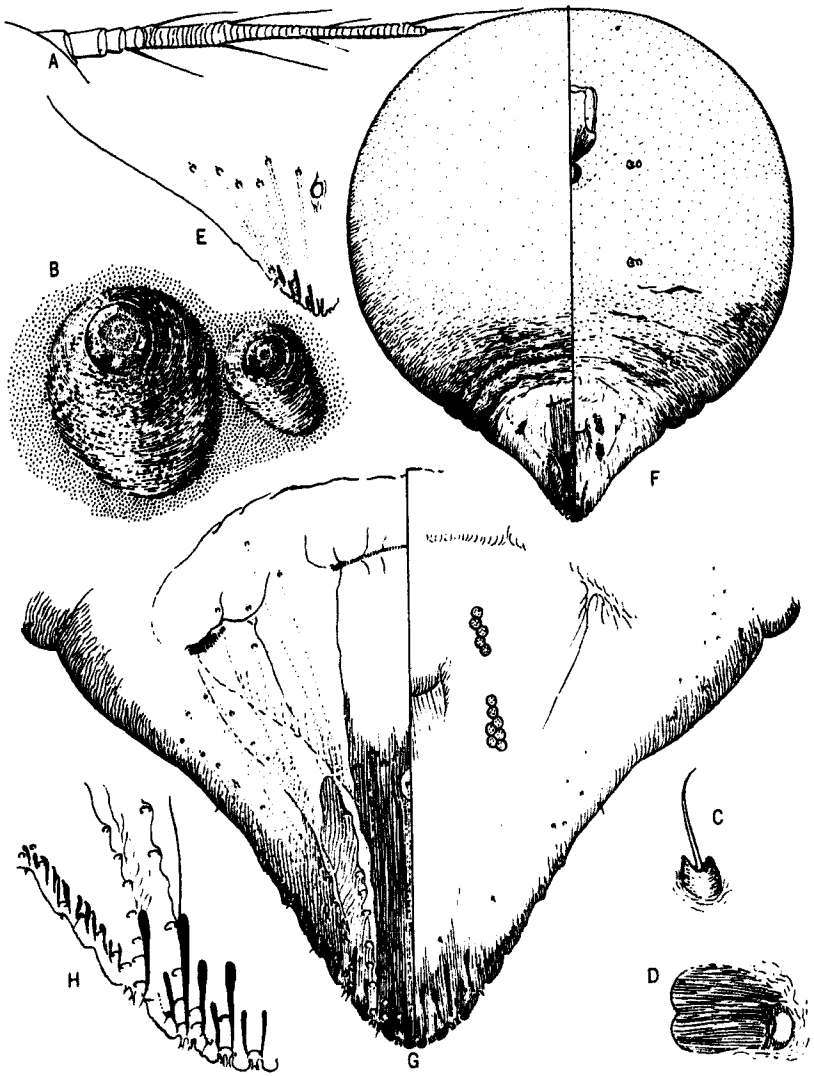

Fig. 4. *Acutaspis albopicta* (Cockerell), albopicta scale.

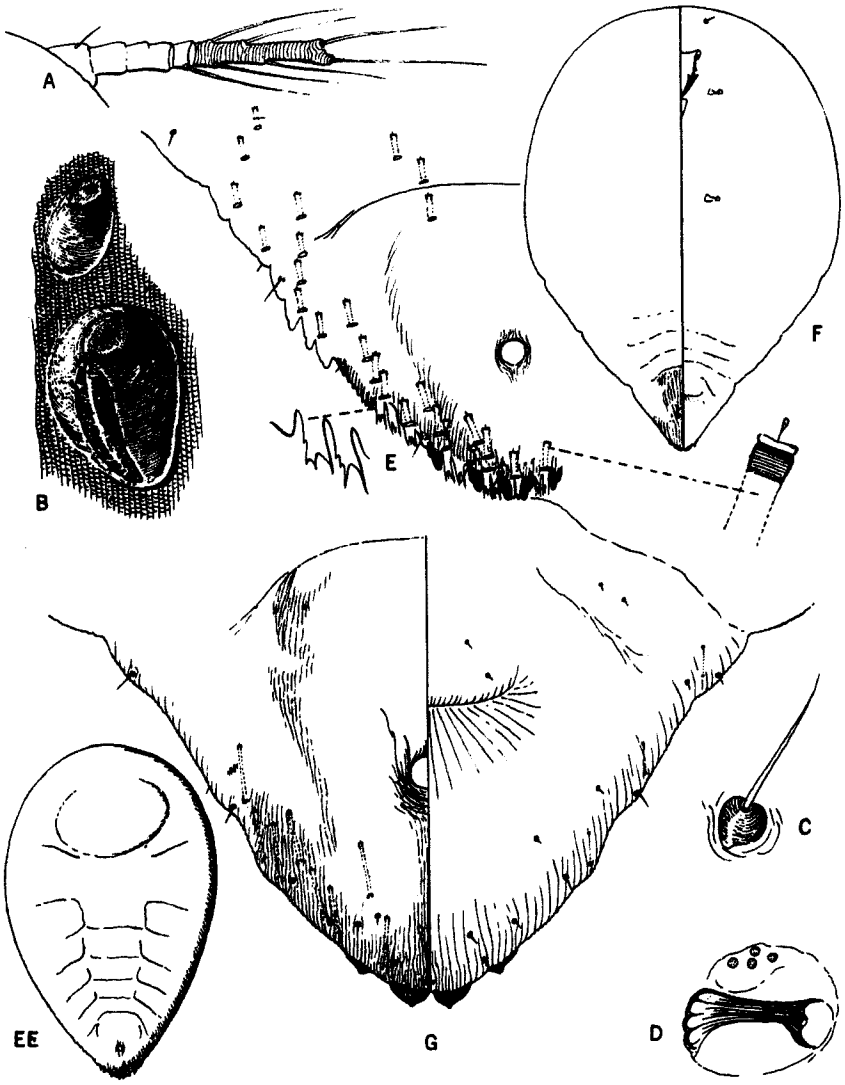

Fig. 5. *Aonidia lauri* (Bouché), laurel scale.

2(1). Perivulvar pores lacking . . . . . *graminis* (Bremner) (p. 163)
Perivulvar pores present; associated with *Cynodon dactylon* (Bermuda grass), and occasionally with certain succulents in California . . . . . *ruthae* Kotinsky (p. 165)

Key to the Species of Genus *Rugaspidiotus* MacGillivray

Body broadly pyriform with prosoma and pygidium deeply sclerotic; pygidial margin crenulate; associated with *Prosopis*, *Acacia*, and similar hosts . . . . . *arizonicus* (Cockerell) (p. 165)
Body oval or somewhat fusiform; sclerotization various; associated with *Eriogonum* in California . . . . . *nebulosus* Ferris (p. 167)

TREATMENT OF SPECIES

Tribe ASPIDIOTINI

The genera and species of California Aspidiotini are arranged alphabetically as follows:

Acutaspis albopicta (Cockerell)
Albopicta scale
(Fig. 4)

Aspidiotus (Chrysomphalus) albopictus Cockerell, 1898, Ann. Mag. Nat. Hist., 7 (1):433.
Aspidiotus albopictus variety *leonis* Townsend and Cockerell, 1898, Jour. N.Y. Ent. Soc., 6:179.
Aspidiotus koebelei Townsend and Cockerell, Jour. N.Y. Ent. Soc., 6:179.
Chrysomphalus albopictus (Cockerell), Fernald, 1903, Catalogue of Coccidae, p. 285.
Chrysomphalus albopictus variety *leonis* (Townsend and Cockerell), Fernald, 1903, Catalogue of Coccidae, p. 286.
Chrysomphalus koebelei (Townsend and Cockerell), Fernald, 1903, Catalogue of Coccidae, p. 291.
Insaspidiotus albopictus (Cockerell), McKenzie, 1939, Microentomology, 4(2):53.
Acutaspis albopicta (Cockerell), Ferris, 1941, Atlas of Scale Insects, Ser. III:330.
Type locality: Cuernavaca, State of Morelos, Mexico.
Type host: Orange.
Relation to host: Occurring on the leaves of its host. Adult female scale dark brown, circular to slightly oval; exuviae near one end; male scale smaller, elongate, similar in color to that of female; exuvia near one end.
Additional hosts: *Citrus* spp. (orange and sour lime), *Cocos nucifera* (coconut), *Gardenia jasminoides* (Cape jasmine), *Hyperbaena denticulata*, *Inga* sp., *Jacquinia* sp., *Musa paradisiaca sapientum* (banana), *Persea americana* (avocado), *Philodendron* sp., and *Tabernaemontana* sp.
Discussion:
The long, acute-shaped pygidium, together with the long and slender paraphyses, aids in the identification of this species. In California the scale has been found infesting *Philodendron* only in nurseries. Wherever found eradicative measures have been taken, but it is definitely known that some of the *Philodendron* plants have been sold to retail trade with no record of purchaser. It is assumed the species is established in California.
California Records:
River side Co.: Banning, XII-16-48 (L. C. Cordill).
San Bernardino Co.: San Bernardino, XI-10-48.
San Francisco Co.: San Francisco, IX-24-47 (A. L. Seeley).

Aonidia lauri (Bouché)
Laurel scale
(Fig. 5)

Aspidiotus lauri Bouché, 1833. Naturgeschichte der Schädlichen Garten Insecten, p. 52.
Aonidia purpurea Targioni, 1869. Targioni's Catalogue, p. 42.
Aonidia lauri (Bouché), Ferris, 1938. Atlas of Scale Insects, Ser. II:176.
Type locality: Europe.
Type host: *Laurus nobilis*, Grecian laurel.
Relation to host: This scale occurs on twigs and leaves of its host. Female scale somewhat oval, rather convex, brown; first exuvia near one end; scale of the male similar in color, oval, exuvia at one end.
Additional hosts: Apparently restricted to *Laurus nobilis*.
Discussion:
This species is considered as a so-called "pupillarial" type of armored scale, the adult female remaining within the exuvia of the second stage which is enlarged and sclerotized dorsally, and forms the greater part of the scale itself. In the second stage the pygidial lobes and plates are well developed, whereas the adult female has these structures greatly reduced.

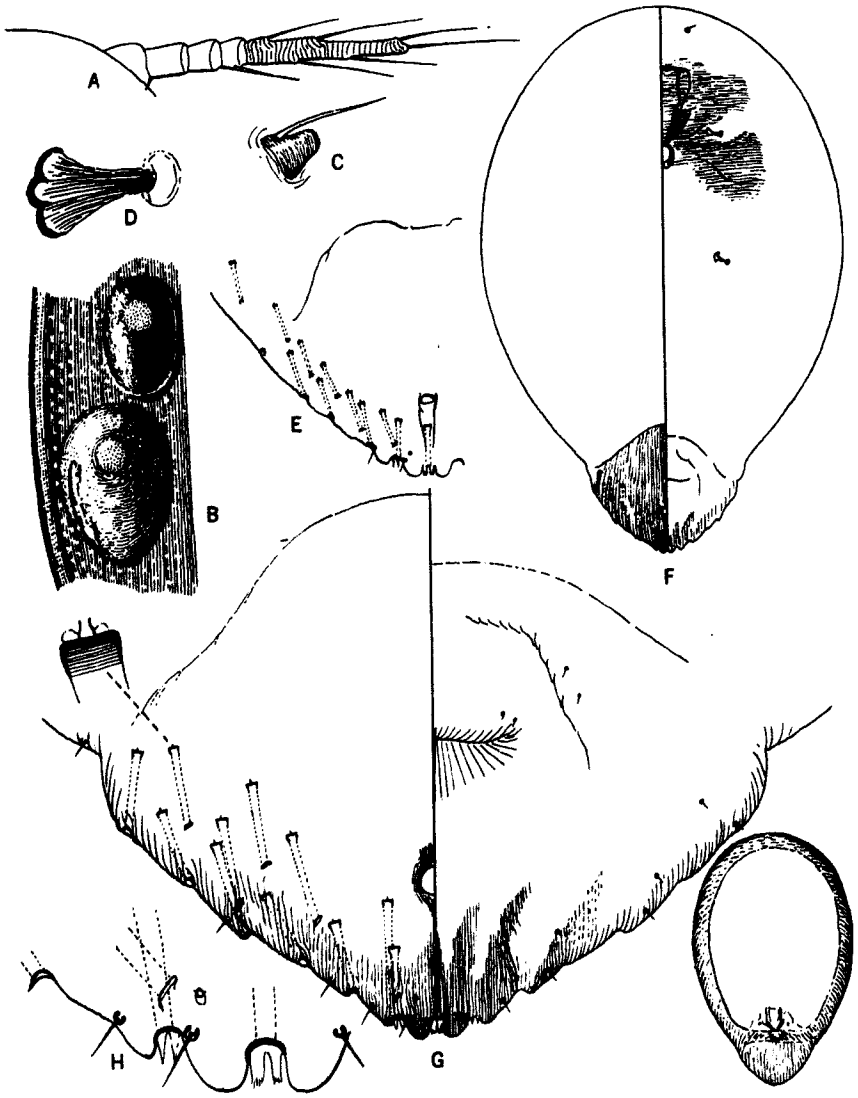

Fig. 6. *Aonidia shastae* (Coleman), redwood scale.

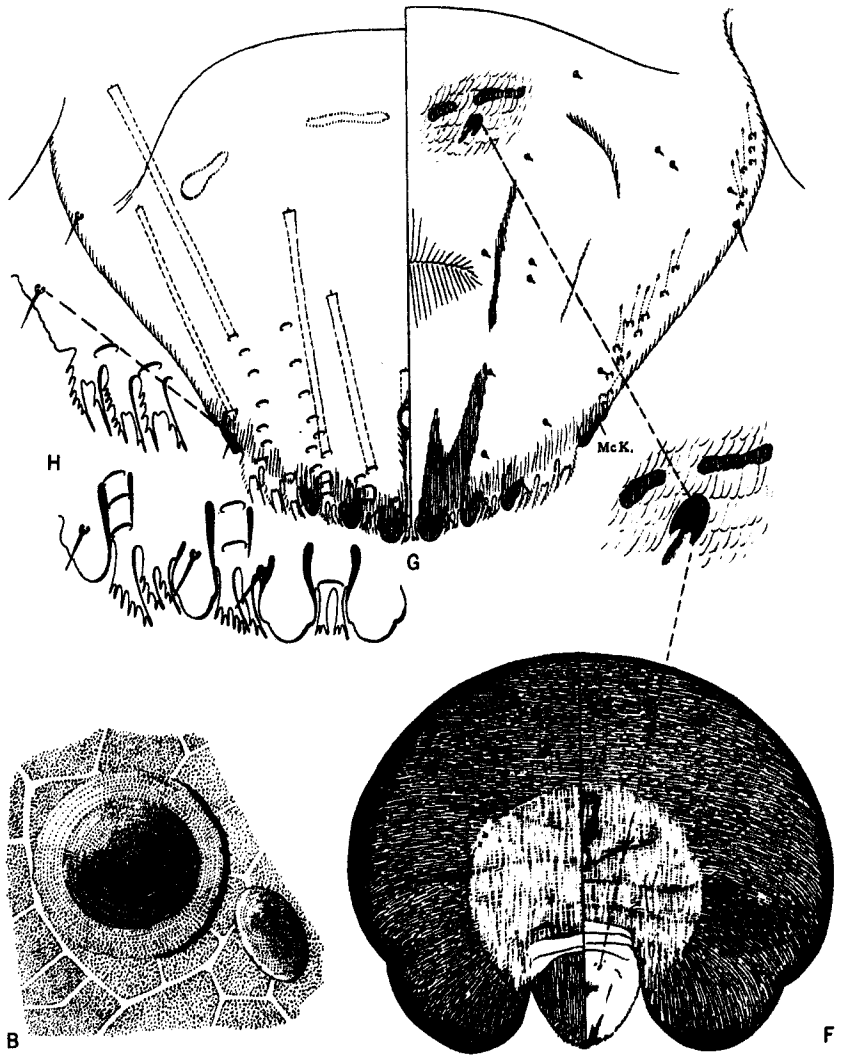

Fig. 7. *Aonidiella aurantii* (Maskell), California red scale.

This species differs from *Aonidia shastae* (Coleman) in lacking pygidial plates between the median lobes and the median and second pygidial lobes.

California records:

Los Angeles Co.: Pasadena, III-4-40 (V. E. Williams).

Santa Clara Co.: Cupertino, III-21-47 (T. B. Gallion).

Aonidia shastae (Coleman)
Redwood scale
(Fig. 6)

Aspidiotus coniferarum variety *shastae* Coleman, 1903, Jour. N.Y. Ent. Soc. 11:67, illus.

Aonidia juniperi Marlatt, 1908, U.S.D.A. Tech. Ser. 16(2):24, illus.

Cryptaspidiotus shastae (Coleman), Ferris, 1920, Stanford Univ. Publ. Biol. Sci., 1(1):55, illus,

Gonaspidiotus shastae (Coleman), MacGillivray, 1921, The Coccodae, p. 432.

Aonidia shastae (Coleman), Ferris, 1938, Atlas of Scale Insects, Ser. II:177.

Type locality: Clear Creek, near Shasta post office, Shasta County, California.

Type host: *Cupressus Macnabiana*, cypress.

Relation to host: This scale infests the leaves and fruit of the host. Female scale elongate oval, composed of the second exuvia which is covered with wax and is gray in color; in rubbed specimens the exuvia is yellow or reddish; scale of male oval; exuvium nearly central.

Additional hosts: *Cupressus Goveniana, Cupressus* spp., *Juniperus* spp., juniper; *Libocedrus decurrens.*, incense cedar, *Sequoia sempervirens.*, redwood.

Discussion:

This scale produces a second exuvia which is larger than, and partly encloses, the adult female. This species differs from *Aonidia lauri* (Bouché) in the possession of pygidial plates between the median lobes and median and second lobes.

California records:

Lake Co.: southern part, VI-21-01 (G. A. Coleman).

Mariposa Co.: Crockers, VII–1918 (G. F. Ferris).

Riverside Co.: Banning, VIII-28-42. Lake Mathews, X-7-47 (F. R. Platt).

San Diego Co.: Jacumba—(R. M. Hawthorne).

San Mateo Co.: Woodside, VII-19-17 (G. F. Ferris).

Santa Clara Co.: Palo Alto, near Stanford Univ. (R. M. Hawthorne).

Shasta Co.: Clear Creek, near Shasta post office.

Stanislaus Co.: Near Mt. Hamilton, II-13-53 (D. Zuckswert).

Aonidiella aurantii (Maskell)
California red scale
(Pl. 1, top row, left; fig. 7)

Aspidiotus aurantii Maskell, 1878, Trans. N.Z. Inst. 11:199.

Aspidiotus citri Comstock, 1881, Canad. Ent., 13:8.

Aspidiotus coccineus Gennadius, 1881, Ann. Soc. ent. Fr., (6), 1:189.

Aonidia gennadii Targioni, 1881, Ann. Agric., p. 151.

Chrysomphalus aurantii (Maskell), Fernald, 1903, Catalogue of Coccidae, p. 288.

Aonidiella aurantii (Maskell), McKenzie, 1937, Univ. Calif. Publ. Entom., 6:323-336, illus.

Aonidiella aurantii (Maskell), McKenzie, 1938, Microentomology, 3(1):6-7, illus.

Aonidiella aurantii (Maskell), Ferris, 1938, Atlas of Scale Insects, Ser. II:179.

Aonidiella aurantii (Maskell), Keifer, 1941, Calif. Dept. Agric., mimeo. Fol. no. 29.

Type locality: Type locality not specified, the species having been recorded as occurring on oranges and lemons imported into New Zealand from Sydney, Australia, and as occurring also on orange at Governor's Bay, New Zealand.

Type host: Orange and lemon.

Relation to host: On *Citrus* it infests trunk, limbs, leaves, and fruit. Female scale circular, translucent, the reddish body of the adult insect showing through it; exuviae central or subcentral; scale of the male gray and elongate.

Additional hosts: In addition to *Citrus* spp. the scale occurs on a long list of other hosts, some of which include *Acacia, Agave, Artocarpus, Cocos, Cycas, Euonymus, Ligustrum,* and *Rosa.*

Discussion:

The California red scale ranks as one of the very most important citrus pests of the world. In most instances the following records do not represent all the localities within the listed counties of California in which *Aonidiella aurantii* (Maskell) has been collected. This is particularly true for most of the southern and interior valley counties in California. It is interesting to note that this scale has spread gradually and persistently from southern California throughout the interior valley counties of California as far north as Butte and Glenn counties. Thriving infestations of the scale are also to be found on grapefruit at Palm Springs, Indio, and Brawley, all desert locations in Riverside and Imperial counties. These instances further indicate its ecological adaptability.

It seems reasonable to assume from these data that this scale is existing very well in the interior valleys of California, and that further spread to the east and west, as well as to the north, may be anticipated, if it is not already an actuality.

For many years *Aonidiella aurantii* (Maskell) and *Aonidiella citrina* (Coquillett) (its nearest related species), were differentiated only by their color and occurrence on the host tree. It was observed, however, that these gross characters were not always reliable, particularly in cases of very heavy infestations of *A. citrina* or where this species had been sprayed or fumigated. Instances of heavy infestations of *A. citrina* often resulted in an overflow of the specimens onto larger tree branches, whereas normally they are restricted to the leaves and fruit. Where spraying or fumigation was done on trees infested with *A. citrina* the color of the scale was often changed to resemble very closely that of *A. aurantii.*

In 1936 Professor H. J. Quayle suggested that I study the scales with an idea of locating some morphological characters which might be used to differentiate the two forms. At his suggestion an investigation was started which resulted in the discovery of certain small apophyses present on the ventral side of the pygidium just anterior to the vulva of both species. However, anterior to these apophyses in *Aonidiella aurantii* (Maskell) are one or sometimes two areas of weaker sclerotization, which are quite variable in form and extent, but of which there is always at least a trace (see fig. 7). In *Aonidiella citrina* (Coquillett) these sclerotized areas anterior to the apophyses are lacking, the most that is ever seen being slight folds or irregularities of the ventral derm. Slight and unimportant as these characters seem to be, they have served for the past eighteen years as precise "key characters" for the differentiation of these species.

California records:

Alameda Co.: Oakland, VI-3-40 (F. J. March). San Leandro, V-20-40 (F. J. March).

Butte Co.: Chico, XII-18-28 (F. E. Todd). Oroville, II-13-46 (R. Swett).

Fresno Co.: Fresno, IX-2-39 (T. B. Gallion). Kerman, III-20-40 (T. B. Gallion). Parlier, XI-15-39 (T. B. Gallion). Reedley, XII-18-39 (T. B. Gallion). Sanger, I-2-41 (J. W. Dixon). Selma, XI-29-39 (T. B. Gallion).

Glenn Co.: Orland, VII-24-47 (H. L. Lundeen). Willows, IV-12-48 (P. V. Harrigan).

Imperial Co.: Brawley, I-24-46 (G. G. Beevor).

Kern Co.: Bakersfield, IX-24-40, (C. S. Morley). Oildale, I-3-39 (J. R. Clark). Taft, IV-4-42 (E. C. McDaniel).

Kings Co.: Hanford, X-11-48 (J. J. Kalstrom and W. E. Lee).

Los Angeles Co.: Los Angeles, X-13-39 (C. R. Tower). Montebello, I-10-34 (C. R. Tower). North Hollywood, III-10-39 (M. R. Bell). Pasadena, IX-12-39 (J. B. Steinweden). South Whittier Heights, XI-28-42 (T. B. Gallion and C. G. Gammon).

Madera Co.: Madera, XII-8-39 (J. W. Dixon).

Merced Co.: Delhi, IX-25-42 (Wilson). Dos Palos, VI-18-42. Gustine, II-25-42 (T. B. Gallion). Winton, VIII-31-42 (E. C. McDaniel).

Napa Co.: Napa (nursery), V-22-46 (M. R. Bell).

Orange Co.: Anaheim, VIII-8-42 (C. R. Tower). East Santiago Creek, III-10-37 (C. E. Norland). Santa Ana, XII-3-42 (C. R. Tower).

Placer Co.: Loomis, XII-9-47 (F. Clark).

River side Co.: Banning, VIII-28-42 (C. R. Tower). Corona, X-8-42 (C. E. Ehmann). Indian Wells, IX-13-43 (F. R. Platt and H. Bloom). Indio, II-26-48 (F. R. Platt). Palm Springs, I-19-44 (D. L. Lindgren). Riverside, XI-25-36 (H. L. McKenzie). San Jacinto, XII-29-42 (F. R. Platt).

Sacramento Co.: Sacramento, XI-28-40 (J. B. Steinweden).

San Bernardino Co.: Ontario, VI-16-42 (C. R. Tower). Redlands, V-13-50 Barstow, San Bernardino, VIII-7-41 (C. R. Tower).

San Diego Co.: Carlsbad, IX-10-40 (D. F. Palmer). El Cajon, VIII-17-39 (R. R. McLean). Escondido, V-24-39 (R. R. McLean). Lemon Grove, XII-20-39 (R. R. McLean). San Diego, VI-40 (R. R. McLean).

San Francisco Co.: San Francisco, VIII-28-38 (F. J. March).

San Joaquin Co.: Escalon, II-26-46 (E. T. Gammon). Manteca, III-25-45 (E. T. Gammon). Stockton, IV-12-46 (J. R. Solari).

San Luis Obispo Co.: San Luis Obispo, X-27-37.

San Mateo Co.: Millbrae, X-25-50 (B. E. Edwards). San Mateo, X-4-50 (B. E. Edwards).

Santa Barbara Co.: Santa Barbara, XI-18-49.

Santa Clara Co.: Los Gatos (nursery), VI-8-50 (G. F. Prole).

Santa Cruz Co.: Santa Cruz, VIII-29-40 (M. Mello).

Solano Co.: Vallejo, VII-2-43 (M. R. Bell).

Stanislaus Co.: Modesto, II-21-40 (J. W. Dixon).

Sutter Co.: Yuba City, XI-27-41 (J. B. Steinweden).

Tehama Co.: Red Bluff, III-22-55 (S. T. Ancell).

Tulare Co.: Dinuba, II-9-48 (O. L. Hemphill). Exeter, IX-29-39 (F. G. Lackland). Lindsay, X-11-39 (F. G. Lackland). Orosi, XII-19-39 (O. L. Hemphill). Visalia, II-24-39 (O. L. Hemphill).

Ventura Co.: Bardsdale, I-19-49 (V. Holmer). Camarillo, VI-1-40 (J. L. Schall). Montalvo, IX-16-39 (W. Daniels). Oxnard, V-2-39 (R. A. Young). Santa Paula, (L. E. Onstott).

Yuba Co.: Marysville, XII-1-41 (H. A. Crane).

Aonidiella citrina (Coquillett)
Yellow scale
(Pl. 1, top row, center; fig. 8)

Aspidiotus citrinus Coquillett, 1891, U.S.D.A., Div. Ent. Bull. (old ser), 23:29.

Aspidiotus (*Aonidiella*) *aurantii* variety *citrinus* Coquillett, Cockerell, 1897, U.S.D.A., Div. Ent. Tech. Ser., 6:29.

Aonidiella aurantii variety *citrina* (Coquillett), Leonardi, 1899, Riv. Patol. veg., 7:187.

Chrysomphalus aurantii variety *citrinus* (Coquillett), Fernald, 1903, Catalogue of Coccidae, p. 288.

Aonidiella citrina (Coquillett), Nel, 1933, Hilgardia, 7:417-466, illus.

Aonidiella citrina (Coquillett), McKenzie, 1937, Univ. Calif. Publ. Entom., 6:324, illus.

Aonidiella citrina (Coquillett), McKenzie, 1938, Microentomology, 3(1):7-8, illus.

Aonidiella citrina (Coquillett), Ferris, 1938, Atlas of Scale Insects, Ser. II:179.

Aonidiella citrina (Coquillett), Keifer, 1941, Calif. Dept. Agri., mimeo. Fol. no. 3.

Type locality: San Gabriel Valley, Los Angeles, California.

Type host: *Citrus sinensis*, orange.

Relation to host: This scale occurs usually on leaves and fruit of *Citrus* spp., although in extremely heavy infestations it may overflow onto the stems and larger branches. Infested leaves show many yellow spots or streaks where the chlorophyll has been removed by feeding scale insects. Female scale flat, circular, translucent, the yellow adult body showing through it, exuviae central or subcentral; scale of the male yellow-gray and elongate.

Additional hosts: In addition to *Citrus* spp., the scale occurs on a long list of hosts, some of which include *Aralia, Arbutus unedo, Aspidistra, Buxus sempervirens, Camellia, Choisya ternata, Elaeagnus, Euonymus, Ficus elastica, Hedera helix, Ilex aquifolium, Jasminum, Laurus cerasus, Leptospermum, Ligustrum, Mahonia aquifolium, Myrtus, Olea europaea, Osmanthus, Persea americana, Photinia arbutifolia, Prunus illicifolia, Prunus Lyoni, Prunus laurocerasus, Viburnum,* and *Rosa.*

Discussion:

The locality records listed above have been taken from the California State Department of Agriculture files. This scale occurs abundantly in the interior areas of California, especially in the San Joaquin and Sacramento valleys in the north and in the Redlands and Highland districts in San Bernardino County in the southern part of the state. It is to be found sparsely distributed in the coastal and intermediate areas.

The species occurs commonly on the leaves and fruit of *Citrus*. This habit preference is different from that of its nearest ally, *Aonidiella aurantii* (Maskell), which occurs on all parts of the tree except the roots. However, in extremely heavy infestations of *A. citrina*, specimens may be found on the twigs and larger branches. *A. citrina* is usually yellow in appearance whereas *A. aurantii* is reddish. When sprayed with an oil spray or fumigated, however, *A. citrina* darkens and much resembles *A. aurantii*. Field characters of this nature are not satisfactory in making final determinations of these species.

Certain morphological details, originally discovered by me, which are present on the ventral side of the pygidium, have served to separate the two scales. Anterior to the vulva there are present in both species certain small apophyses. Anterior to these apophyses in *A. aurantii* there are areas of sclerotization which are not found in *citrina* (see fig. 7). The most that is ever seen in this area on *citrina* are slight folds or irregularities of the ventral derm on the pygidium (see fig. 8). The absence of these tiny sclerotizations has successfully differentiated *A. citrina* from *A. aurantii* for the past eighteen years.

California records:

Alameda Co.: Berkeley, VI-13-40 (F. J. March).

Butte Co.: Chico, XII-18-28 (F. E. Todd). Oroville, IV-9-41 (J. W. Dixon).

Fresno Co.: Fresno, XI-12-35 (F. J. March). Kingsburg, XII-29-39 (T. B. Gallion). Reedley, V-17-51 (E. Rose).

Glenn Co.: Butte City, XII-27-39 (J. H. Shokley). Orland, V-20-41 (J. W. Dixon).

Kern Co.: Bakersfield, I-20-39 (J. B. Steinweden). Oildale, V-12-41 (T. B. Gallion). Stockdale, VI-17-41 (T. B. Gallion).

Kings Co.: Armona, VI-10-41 (T. B. Gallion). Hanford, II-10-39 (L. O. Haupt).

Los Angeles Co.: Altadena, XII-13-39. Baldwin Park, X-21-38. Compton, X-27-34. East Pasadena, IX-27-37 (V. E. Williams). Glendale, I-6-39. (M. R. Bell). La Crescenta, IV-15-40. Montebello, X-24-39 (C. R. Tower). Pomona, I-6-38 (V. E. Williams). San Dimas, III-5-41. San Fernando, IX-25-37 (V. E. Williams). San Gabriel, V-2-38.

Merced Co.: Dos Palos, VI-18-42 (Lawson). Merced, II-20-41 (J. W. Dixon).

Riverside Co.: Moreno Valley, XI-1-43 (F. R. Platt). Riverside, X-16-42 (C. E. Ehmann).

Sacramento Co.: Carmichael, V-29-33 (E. T. Gammon). Perkins, XI-23-37. Sacramento, XII-12-36 (H. H. Keifer).

San Bernardino Co.: Highland, II-19-38 (J. P.

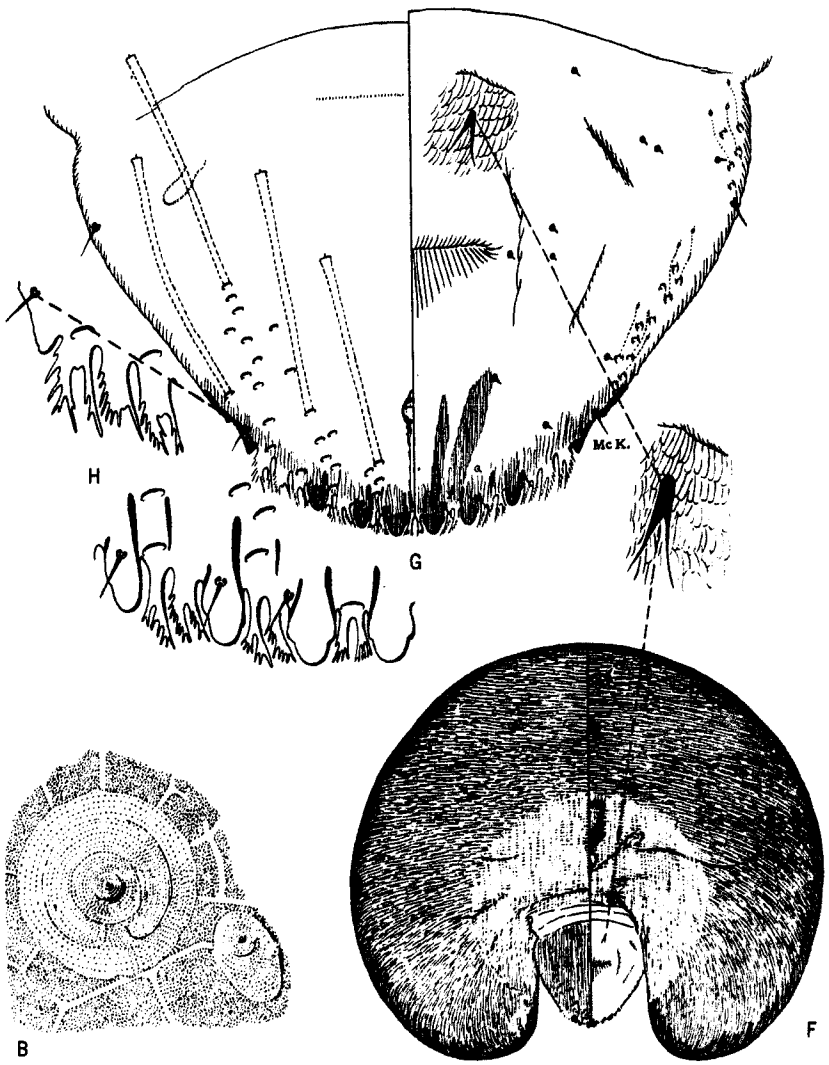

Fig. 8. *Aonidiella citrina* (Coquillett), yellow scale.

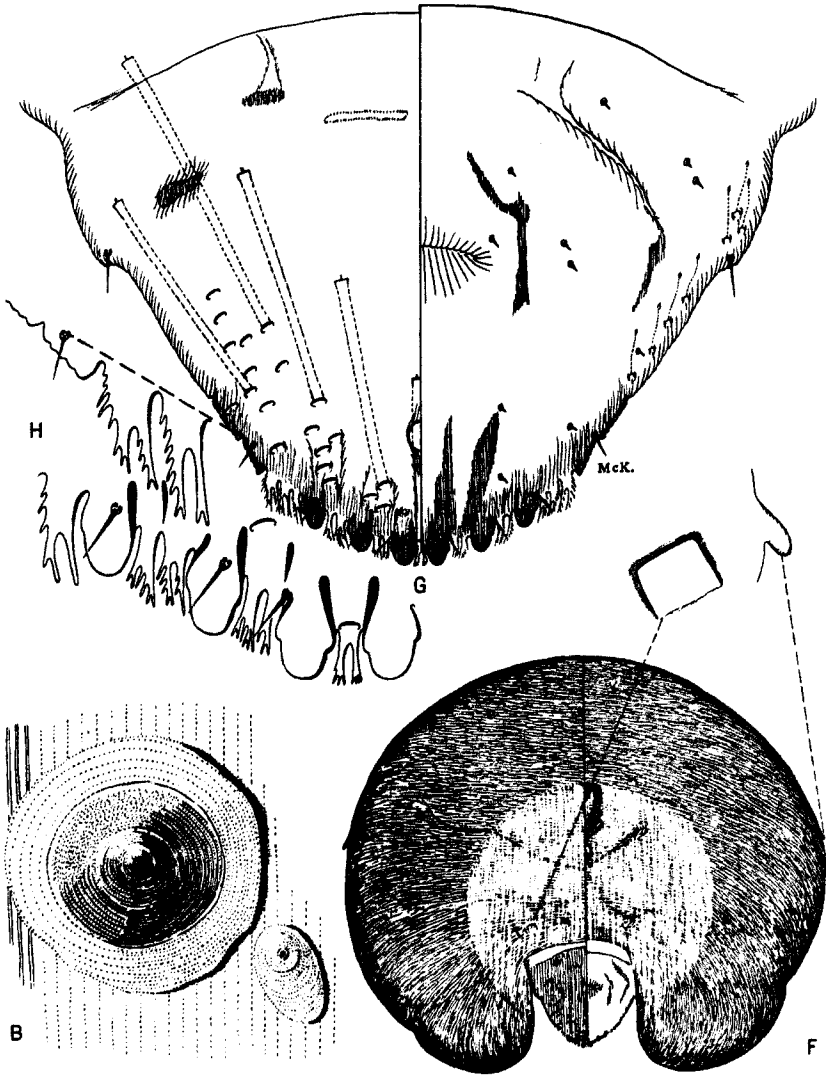

Fig. 9. *Aonidiella taxus* Leonardi, Asiatic red scale.

Coy). Ontario, VII-9-41 (C. R. Tower). Uplands, III-1-32.

San Diego Co.: El Cajon, IX-20-38 (D. F. Palmer). Encinitas, VI-1-39 (R. Wurtz).

Santa Barbara Co.: Goleta, V-6-32 (G. E. Woodhams).

Santa Clara Co.: San Jose, VII-6-40 (L. R. Cody). Santa Clara, I-22-47.

Solano Co.: Dixon, VII-11-40 (E. Peters).

Stanislaus Co.: Modesto, I-10-44 (T. B. Gallion).

Sutter Co.: Live Oak, III-10-33 (E. H. Fosen). Yuba City, II-3-37 (Corbett).

Tehama Co.: Red Bluff, VII-2-35 (G. W. Sykes).

Tulare Co.: Dinuba, III-25-41 (O. Ohrt). Exeter, IX-27-39 (G. F. Lackland). Ivanhoe, XI-14-40 (R. S. Woglum). Lemon Cove, VIII-19-40 (F. G. Lackland). Orosi, XII-15-39 (F. G. Lackland). Tulare, XII-27-49 (H. Compere). Visalia, IX-13-39 (F. G. Lackland). Woodlake, XII-12-42 (J. W. Dixon).

Ventura Co.: Fillmore, VII-3-42 (R. A. Young). Limoneira, VIII-31-40 (U. L. White). Montalvo, XII-4-39 (R. A. Young). Oxnard, IV-25-41 (R. A. Young). Piru, XI-9-49 (C. J. Barrett). Santa Paula, X-20-42 (J. L. Schall). Saticoy, XI-7-40 (R. A. Young). Simi, XI-8-32 (W. M. Dunning).

Yolo Co.: Clarksburg district, III-14-39 (O. Ohrt).

Yuba Co.: Marysville, XII-17-38 (H. A. Crane).

Aonidiella taxus Leonardi
Asiatic red scale
(Fig. 9)

Aonidiella taxus Leonardi, 1906, Redia, 3:1, illus.

Aonidiella taxus Leonardi, Lupo, 1936, Boll. Lab. Zool. Portici, 29:257, illus.

Aonidiella taxus Leonardi, McKenzie, 1936, Univ. Calif. Publ. Entom., 6:327, illus.

Aonidiella taxes Leonardi, McKenzie, 1938, Microentomology 3(1):15, illus.

Aonidiella taxus Leonardi, Keifer, 1941. Calif. Dept. Agric., mimeo. Fol. no. 32.

Aonidiella taxus Leonardi, Ferris, 1942, Atlas of Scale Insects, Ser. IV:425.

Type locality: Italy.

Type host: *Taxus baccata*, English yew.

Relation to host: Occurring on the foliage and twigs of the host. Female scale thin and translucent with the reddish body of the insect showing through, a wide marginal zone is developed greatly exceeding the body of the insect itself; scale of the male gray, elongate.

Additional hosts: *Podocarpus andinus, P. elongatus, P. macrophylla, P. nageia, P. neriifolia,* and *P. sinensis.*

Discussion:

This scale is reddish and similar in appearance to *Aonidiella aurantii* (Maskell). It does, however, tend to develop a wide marginal zone much exceeding the body of the insect itself, this being slightly different from that of *A. aurantii.*

Infestations of the Asiatic Red Scale at Alhambra and Redlands were confined to a single yew tree at each location. These two trees were subsequently cut down and burned. It is presumed that the scale is eradicated from the state.

It may be distinguished from *A. aurantii* and *A. citrina* by the total absence of ventral pygidial apophyses and scleroses (see fig. 5).

California records:

Los Angeles Co.: Alhambra, VII-6-39 (V. E. Williams).

San Bernardino Co.: Redlands, VIII-10-49 (G. Harper and R. F. Camblin).

Aspidaspis arctostaphyli (Cockerell and Robbins)
Arctostaphylis scale
(Fig. 10)

Aspidiotus arctostaphyli Cockerell and Robbins, 1909, Jour. N.Y. Ent. Soc., 17(3):104, illus.

Aspidiella arctostaphyli (Cockerell and Robbins), MacGillivray, 1921, The Coccidae, p. 404.

Aspidaspis arctostaphyli (Cockerell and Robbins), Ferris, 1938, Atlas of Scale Insects, Ser. II:182.

Type locality: Red Bluff, Tehama County, California.

Type host: *Arctostaphylos viscida,* white-leaf manzanita.

Relation to host: Occurring on either twigs or leaves. Female scale quite flat, circular, brownish, darker centrally; exuviae central or subcentral; scale of male elongate oval, quite dark.

Additional hosts: *Arbutus menziesii, Arctostaphylos glauca, A. manzanita,* and *Umbellularia californica.*

Discussion:

According to Ferris (1938) this species is extremely close to *Aspidaspis densiflorae* Bremner. *A. densiflorae,* however, generally occurs upon tanbark oak at low altitudes in the rather moist coastal mountains, whereas *A. arctostaphyli* occurs characteristically on species of the genus *Arctostaphylos* on the drier mountains and at much higher altitudes.

Morphologically the two species differ only in that in *A. arctostaphyli* the dorsal ducts are much more abundant, especially on the prepygidial abdominal segments, than they are in *A. densiflorae.* In addition the scale of *A. arctostaphyli* is much darker brown than that of *densiflorae.*

California records:

Butte Co.: Magalia, X-30-39 (H. H. Keifer).

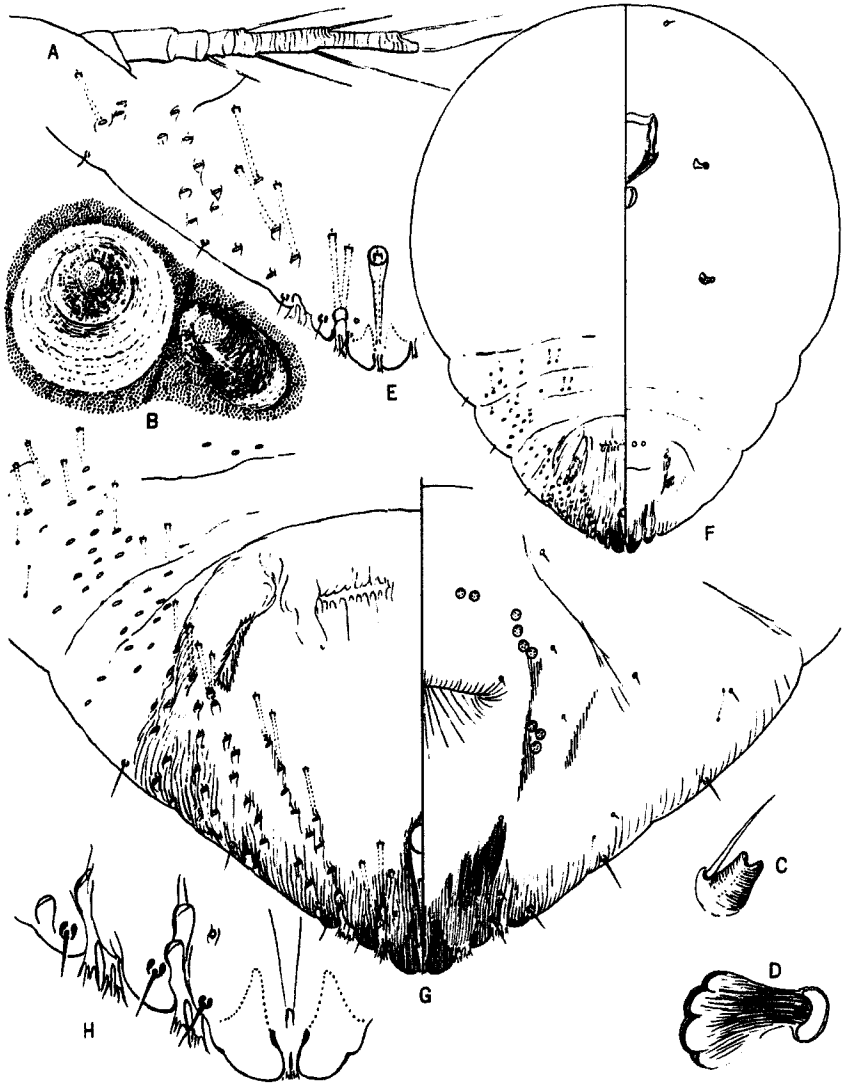

Fig. 10. *Aspidaspis arctostaphyli* (Cockerell and Robbins), Arctostaphyli scale.

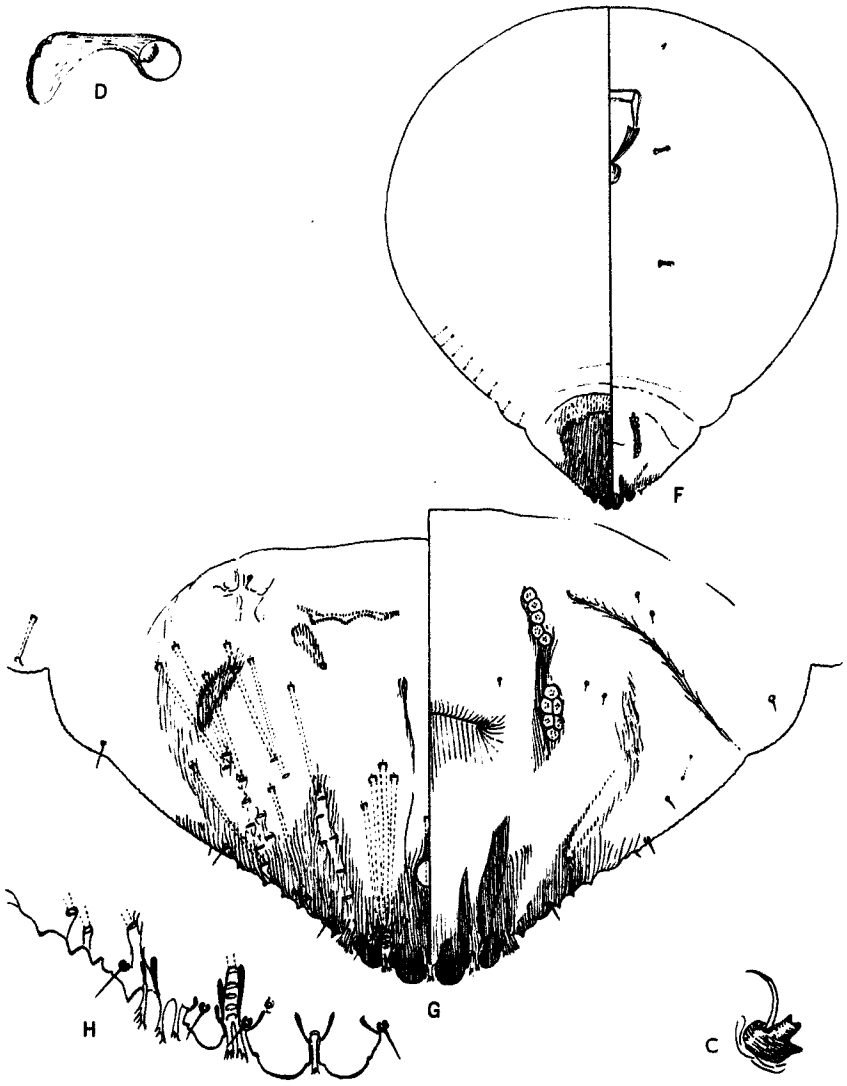

Fig. 11. *Aspidaspis braunschvigi* (Rungs), Braunschvigi scale.

El Dorado Co.: Placerville, III-24-32 (A. C. Browne).

Fresno Co.: Cedar Crest, VIII-9-49 (J. W. Dixon).

Madera Co.: North Fork, VII-30-42 (E. T. Gammon).

Mariposa Co.: Yosemite National Park.

San Diego Co.: Jacumba, III-19-39 (G. F. Ferris).

Santa Clara Co.: Los Gatos (F. B. Herbert). Mount Hamilton, 3,500 feet, IX-19-37 (G. F. Ferris).

Tulare Co.: Three Rivers, XII-15-42 (J. W. Dixon).

Aspidaspis braunschvigi (Rungs)
Braunschvigi scale
(Fig. 11)

Aspidiotus braunschvigi Rungs, 1936, Bull. Soc. ent. Fr., 41:329, illus.

Aspidaspis braunschvigi (Rungs), Ferris, 1942, Atlas of Scale Insects, Ser. IV:426.

Type locality: Oujda, Eastern Morocco.

Type host: *Pistacia atlantica*, pistachio.

Relation to host: Occurring on the leaves. The adult female scale, as described by Rungs is "flat, more or less circular, translucid, frequently having the appearance of oiled paper, dirty gray or gray yellow. Exuviae red or brown, frequently eccentric. Scale of the male smaller, more elongate, clearer, sometimes whitish."

Additional hosts: *Ficus carica.*

Discussion:

This species differs from *Aspidaspis florenciae* (Coleman) in having slender plates and marginal serrations of the pygidium, and with the prosoma membranous at full maturity. The scale is rare in California.

California records:

Santa Clara Co.: San Jose, Di Giorgio Ranch, XII-29-39 (A. M. Foster).

Aspidaspis densiflorae (Bremner)
Tan oak scale
(Fig. 12)

Aspidiotus densiflorae Bremner, 1907, Canad. Ent., 39:366, illus.

Aspidiella densiflorae (Bremner), MacGillivray, 1921, The Coccidae, p. 405.

Aspidaspis densiflorae (Bremner), Ferris, 1938, Atlas of Scale Insects, Ser. II:183.

Type locality: Mendocino County, California.

Type host: *Lithocarpus* (=*Pasania*) *densiflorus*, tanbark oak.

Relation to host: Apparently confined to the leaves only. Adult female scale almost white, quite convex; scale of the male almost blue-gray, elongate oval.

Additional hosts: *Mahonia aquifolium, Quercus agrifolia, Q. chrysolepis, Q. tomentella, Q. wislizenii,* and *Rhus integrifolia.*

Discussion:

This species occurs normally on *Lithocarpus* (*-Pasania*) *densiflorus*, and it is believed that its presence on the genus *Quercus* is exceptional.

This scale is very closely allied to *Aspidaspis arctostaphyli* (Cockerell and Robbins) but differs from it in having fewer submarginal dorsal ducts on all the prepygidial abdominal segments.

California records:

Butte Co.: Oroville, X-15-39 (H. H. Keifer). Yankee Hill, V-15-50 (F. R. Platt).

Fresno Co.: Auberry, IV-29-53 (H. B. Dunnegan and W. Botte).

Glenn Co.: Orland, X-21-47 (H. L. McKenzie and (H. L. Lundeen).

Los Angeles Co.: Claremont (near), VII-17-44 (H. L. McKenzie).

Mendocino Co.: Specific location not cited in original description.

Sacramento Co.: Folsom, 1937 (H. H. Keifer).

San Benito Co.: Panoche, XII-13-49.

San Diego Co.: Palomar Mountain, XI-27-54 (R. F. Wilkey).

San Mateo Co.: Woodside, VII-19-17 (G. F. Ferris).

Santa Clara Co.: Stanford University, I-15-17 (G. F. Ferris).

Siskiyou Co.: Dunsmuir, IX-16-35 (H. S. Fawcett).

Aspidaspis florenciae (Coleman)
Florence scale
(Fig. 13)

Aspidiotus florenciae Coleman, 1903, Jour. N.Y. Ent. Soc., 11:68, illus.

Aspidaspis florenciae (Coleman), Ferris, 1938, Atlas of Scale Insects, Ser. II:184.

Type locality: Originally described from examples taken from herbarium specimen collected at Pine Ridge, above Madrone Springs, Santa Clara County, California.

Type host: *Pinus ponderosa*, yellow pine.

Relation to host: Occurring on the needles. Female scale elongate, color variable, some almost completely white, others with a darker center and pale margins, exuviae subcentral; scale of the male not observed.

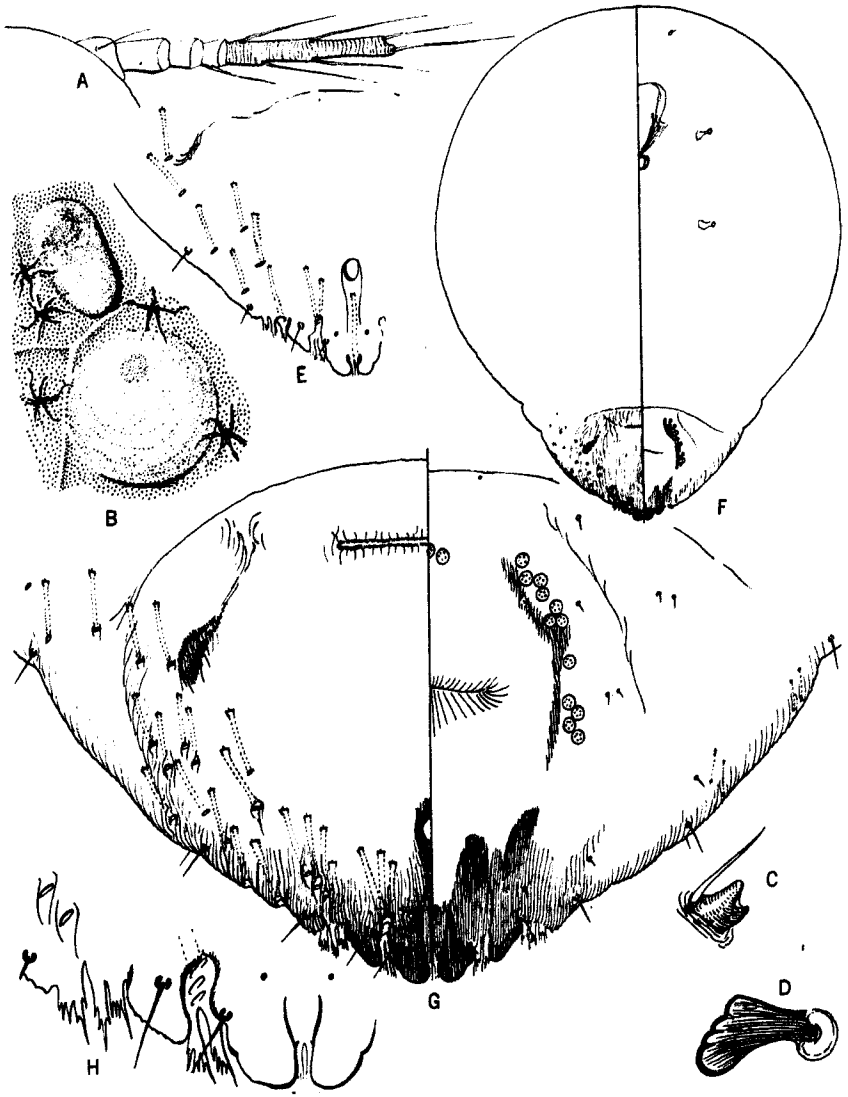

Fig. 12. *Aspidaspis densiflorae* (Bremner), tan oak scale.

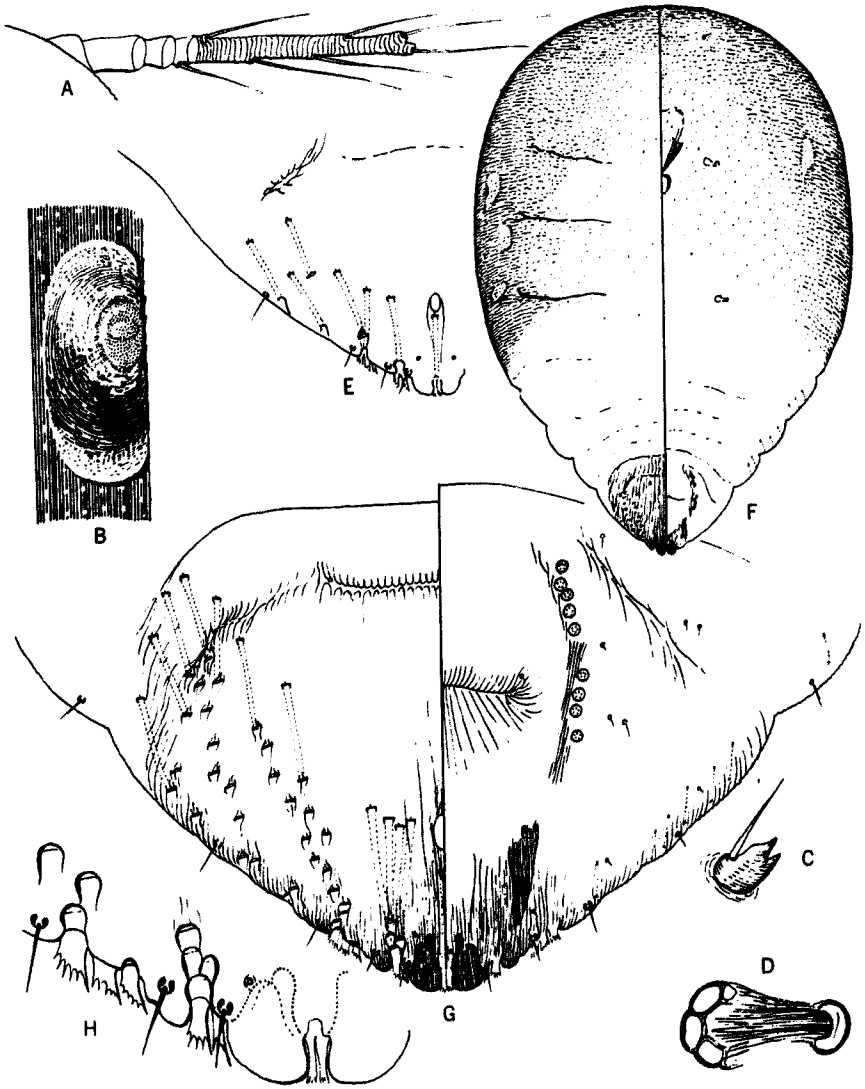

Fig. 13. *Aspidaspis florenciae* (Coleman), Florence scale.

Additional hosts: *Pinus coulteri.*
Discussion:

This species is very similar in its pygidial characters to *Aspidaspis arctostaphyli* (Cockerell and Robbins) and *Aspidaspis densiflorae* (Bremner), but the elongate body form and sclerotization of cephalothoracic region suggest that it is definitely distinct.

The single example examined from San Diego County shows a few dorsal submarginal pygidial macroducts on the fourth abdominal segment. All other characters agree with those illustrated by Professor G. F. Ferris, and it is here assumed that this species is correctly placed as *Aspidaspis florenciae.*

California records:

San Diego Co.: Cuyamaca State Park, IV-4-52 (R. F. Wilkey).

Santa Clara Co.: Mount Hamilton, III-14-40 (G. F. Ferris). Pine Ridge, 1937 (G. Coleman).

Aspidiotus destructor Signoret
Coconut scale
(Fig. 14)

(Selected taxonomic references only)

Aspidiotus destructor Signoret, 1869, Ann. Soc. ent. Fr. (Series 4), 9:120, illus.

Aspidiotus transparens Green, 1890, Insect Pests of the Tea Plant, p. 20.

Aspidiotus fallax Cockerell, 1893, Jour. Inst. Jamaica, 1:255.

Aspidiotus cocotis Newstead, 1893, Ent. Mon. Mag., 39:186.

Aspidiotus destructor Signoret, Cockerell, 1894, Ent. News, 5:79.

Aspidiotus lataniae Signoret, Green, 1896, Coccidae of Ceylon, 1:49, illus. (Misidentifies *destructor* as *lataniae*; synonymy of *transparens* indicated.)

"*Aspidiotus vastatrix* Leroy," reference not located.

Aspidiotus destructor Signoret, Fernald, 1903, Catalogue of Coccidae, p. 257.

Aspidiotus simillimus variety *translucens* Cockerell, Fernald, 1903, Catalogue of Coccidae, p. 278. (New name for *transparens* Green.)

Aspidiotus oppugnatus Silvestri, 1914, Boll. Lab. Zool. Portici, 9:258.

Aspidiotus destructor-transparens Maskell-Green (*sic*), Green, 1915, Bull. Ent. Res., 6:44.

Aspidiotus destructor Signoret, MacGillivray, 1921. The Coccidae, p. 396.

Aspidiotus destructor Signoret, Ferris, 1938, Atlas of Scale Insects, Ser. II:191.

Aspidiotus destructor Signoret, Ferris, 1941, Microentomology, 6(2):51-53, illus.

Type locality: Island of Reunion in Indian Ocean.

Type host: *Cocos nucifera* and *Phoenix* spp., coco and date palms.

Relation to host: Occurring normally on the leaves. Adult female scale circular, very thin and delicate, almost transparent, flat, straw-colored, exuviae central and quite pale; male scale elongate but otherwise similar in color and texture to that of adult female.

Additional hosts: Ferris (1941) states that the species seems to affect especially the coco palm (*Cocos nucifera*), but that it does occur on other palms and numerous other hosts as well. A few of these hosts include: *Mangifera indica, Musa paradisiaca sapientum, Pandanus* sp., *Psidium* sp., and *Saccharum officinarum.*

Discussion:

This species presents a wide range of variation in certain pygidial structures, especially in the size of the median and second pygidial lobes. This has led to a considerable nomenclatorial tangle as is evidenced by the synonymical literature cited above.

Ferris (1941) has examined a very considerable amount of material of *destructor* during the preparation of his revision of this genus. He believes that only one species is involved although in some specimens the second pygidial lobes are noticeably longer than the median lobes, and that every degree of variation may be found in specimens from the same lot. Consequently, he sees no reason for considering that there are two species.

This species has been found only in California nurseries. Whenever found, however, it is immediately eradicated. The scale was found established in California as early as 1935. In 1951 another nursery received 5,030 palms (originating from Florida) and before the scale was detected and fumigated, 677 of the plants had been sold to retail trade with no record of sale. The remainder of the nursery plants were the subject of eradicative treatment.

California records:

Los Angeles Co.: Los Angeles, III-19-51 (L. E. Myers). Montebello, II-11-35 (V. E. Williams).

Stanislaus Co.: Turlock, II-9-55 (E. T. Shultz).

Aspidiotus hederae (Vallot)
Ivy scale
(Pl. 1, middle row, left; fig. 15)

Chermes hederae Vallot, 1829, Mém. Acad. Sci. Dijon, p. 30.

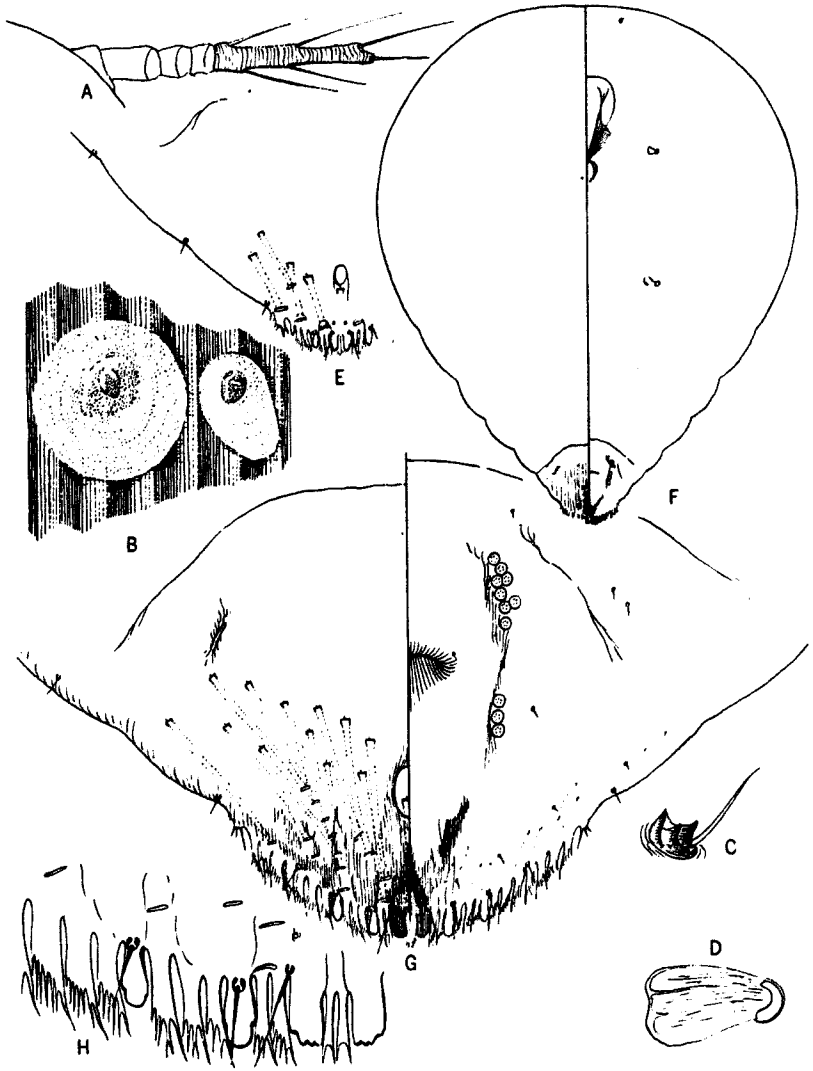

Fig. 14. *Aspidiotus destructor* Signoret, coconut scale.

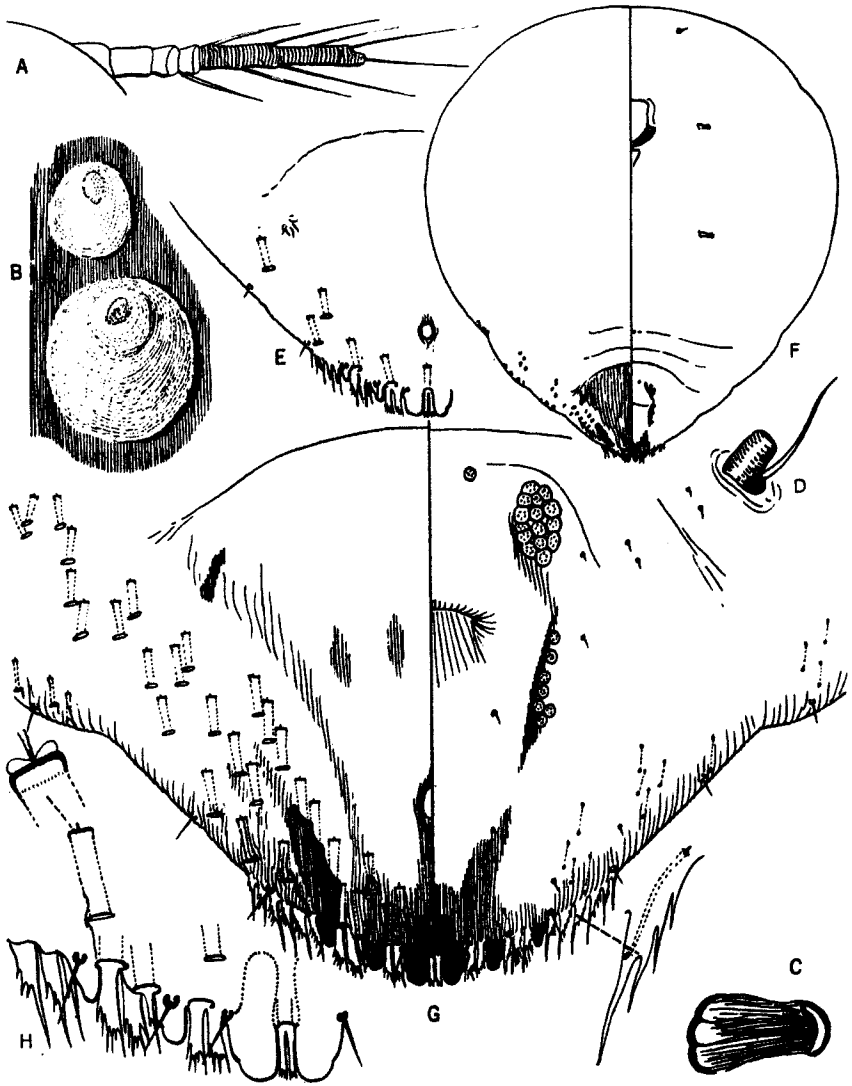

Fig. 15. *Aspidiotus hederae* (Vallot), ivy scale.

Chermes capparis Vallot, Mém. Acad. Sci. Dijon, p. 30.

Aspidiotus nerii Bouché, 1833, Naturgeschichte der schädlichen und nützlichen Garten-Insecten, p. 52.

Aspidiotus vagabundus Cockerell, 1899, Biol. cent.-amer., 2(2):20.

Aspidiotus hederae (Vallot), Ferris, 1938, Atlas of Scale Insects, Ser. II:192.

Aspidiotus hederae (Vallot), Ferris, 1941, Microentomology, 6(2):54-56, illus.

The last named publication by Ferris (1941) lists a total of thirty-four references dealing with the synonymy of this species. Ferris states that "the following bibliography is intended merely to indicate synonymy, it being entirely impracticable —not to say useless—to attempt the listing of all references to this widespread and common species." It seems unnecessary to repeat all these names together with their various combinations. Consequently, only those are cited above which indicate its nomenclatorial history so far as it is pertinent to North America.

Type locality: Europe.

Type host: Not indicated.

Relation to host: Occurring on bark, leaves, and fruit. Female scale white or pale gray, flat, circular with exuviae subcentral; scale of male similar in color, slightly oval, exuvia near one end.

Additional hosts: The host list for this scale is endless, probably any plant, woody or herbaceous, being acceptable. A very few which might be mentioned are: *Acacia, Agave, Arctostaphylos, Aucuba, Bergenia crassifolia, Buddleia, Camellia, Ceanothus, Ceratonia siliqua, Citrus, Cycas, Cymbidium, Hedera helix, Hypericum, Ilex aquifolium, Laurus, Ligustrum, Olea europeae, Persea americana, Phoenix, Quercus, Rhamnus californica, Taxus,* and *Vitis.*

Discussion:

In California this species most closely resembles *Aspidiotus spinosus* Comstock but may be differentiated from it by the noticeably short and rather broad dorsal ducts and by the much larger anal opening which is removed by approximately four times its diameter from the apices of the median lobe basal scleroses. *A. spinosus* has longer and more slender dorsal ducts and the anal opening is small and near the median lobe scleroses.

California records: Listed below are a few of the locality records accumulated in the collection of the California State Department of Agriculture.

Alameda Co.: Berkeley, VI-1-36 (G. B. Laing). Hayward, III-15-34 (F. J. March). Niles, V-4-38 (J. B. Steinweden and M. L. Jones).

Butte Co.: Bangor, IV-9-29 (H. A. Crane). Chico, 1-26-35 (W. B. Carter). Oroville, VIII-26-32 (Whitney).

Fresno Co.: Fresno, IV-25-38 (F. P. Roullard).

Kern Co.: Bakersfield, I-6-39 (J. R. Clark). Wasco, I-17-34 (C. S. Morley).

Los Angeles Co.: Altadena, IV-18-33 (L. E. Meyers). Claremont, XI-30-44 (H. L. McKenzie and C. Gammon). San Gabriel, III-12-33 (C. R. Tower).

Monterey Co.: Marina, VII-13-42 (M. R. Bell).

Orange Co.: Anaheim, XII-3-35 (C. E. Norland). Orange, X-3-33. Santiago Creek, II-11-37 (C. E. Norland. Westminster, II-1-39 (C. E. Norland).

Sacramento Co.: Sacramento, III-20-39 (O. Ohrt).

San Bernardino Co.: Ontario, V-21-37 (L. Stratton).

San Diego Co.: Chula Vista, VI-37 (F. T. Thorne). El Cajon, III-24-36 (J. O. Brodeur). San Diego, VII-12-37 (D. F. Palmer).

San Joaquin Co.: Stockton, VI-40 (P. F. Wright). Tracy, III-25-41 (A. R. Tugel).

San Luis Obispo Co.: San Luis Obispo, XI-14-43 (R. H. Smith).

San Mateo Co.: Redwood City, I-1-35 (R. O. Brandt).

Santa Barbara Co.: Santa Barbara, I-20-32 (G. E. Woodhams).

Santa Clara Co.: Gilroy, X-16-42 (M. R. Bell). Sunnyvale, XI-22-32 (L. R. Cody).

Santa Cruz Co.: Capitola, VII-30-43 (M. R. Bell and M. Mello). Santa Cruz, IV-24-35 (L. B. Sherrill). Watsonville, X-26-33 (F. J. March).

Stanislaus Co.: Modesto, XII-9-43 (J. W. Dixon).

Tulare Co.: Porterville, II-3-39 (J. W. Dixon). Strathmore, IV-6-37 (R. W. Schmitt).

Ventura Co.: Camarillo, IV-30-32 (E. L. Smith). Moorpark, I-11-34 (W. M. Dunning). Santa Paula, IX-6-35 (E. L. Smith). Ventura, I-21-36 (E. L. Smith).

Yuba Co.: Marysville, XI-9-31.

Aspidiotus spinosus Comstock
Spinose scale
(Fig. 16)

Aspidiotus spinosus Comstock, 1883, 2d Rep. Dept. Ent. Cornell Univ., 2:70.

Aspidistus (typographical error) *persearum* Cockerell, 1898, Entomologist, 31:240.

Aspidiotus spinosus Comstock, Ferris, 1921, Stanford Univ. Publ. Biol. Sci., 1:128, illus.

Aspidiotus spinosus Comstock, MacGillivray, 1921, The Coccidae, p. 398.

Aspidiotus persearum Cockerell, MacGillivray, 1921, The Coccidae, p. 403.

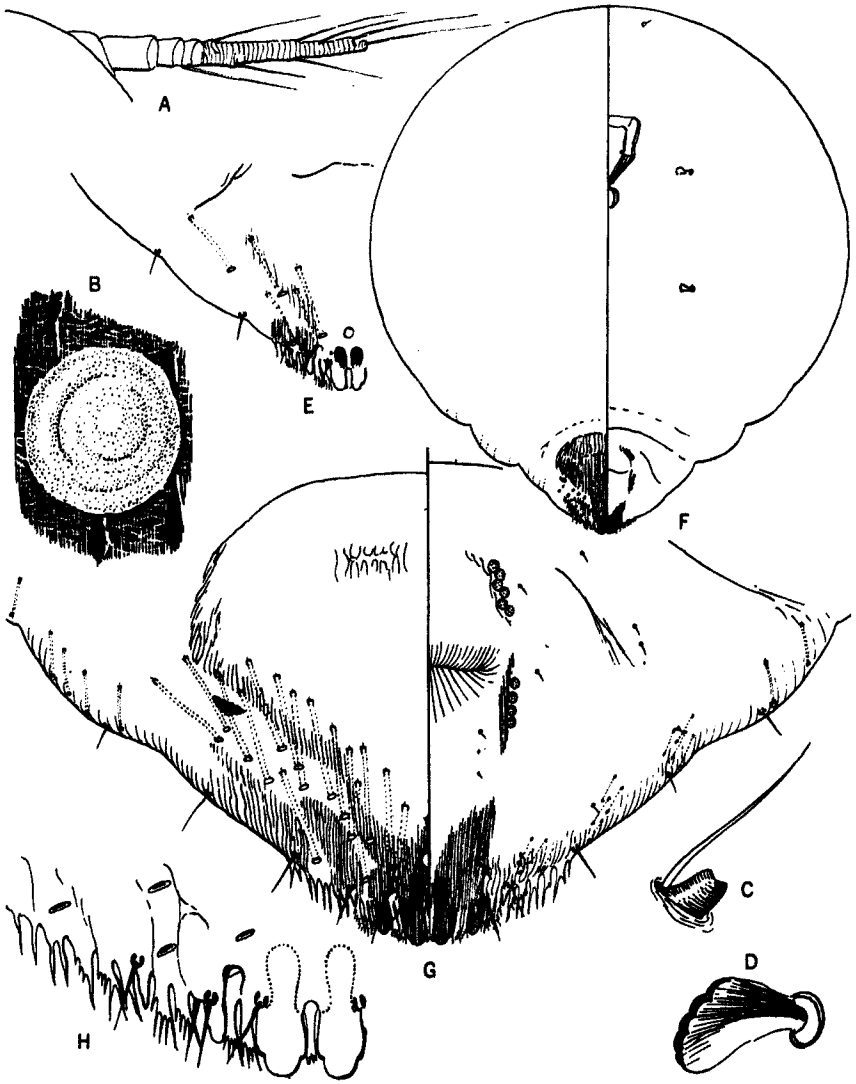

Fig. 16. *Aspidiotus spinosus* Comstock, spinose scale.

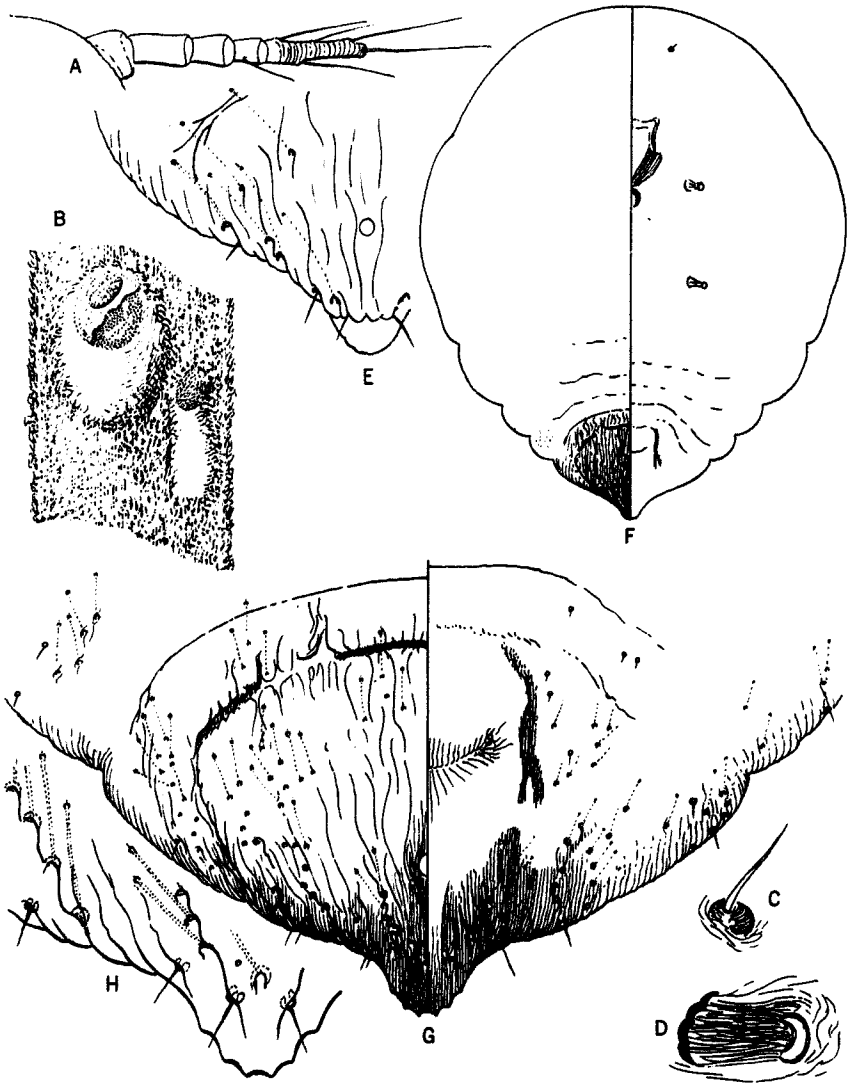

Fig. 17. *Chortinaspis consolidata* Ferris, grass scale.

Aspidiotus spinosus Comstock, Ferris, 1938, Atlas of Scale Insects, Ser. II:193.

Aspidiotus spinosus Comstock, Ferris, 1941, Microentomology, 6(2):58-59, illus.

Type locality: Washington, D.C., in a greenhouse.

Type host: *Camellia,* camellia.

Relation to host: Occurring on either leaves or bark of host. Female scale whitish or straw color, flat, exuviae central; scale of the male described as slightly elongate.

Additional hosts: This scale insect is very omnivorous, and its host list is long, A few of these are: *Asparagus, Cinnamomum, Euonymus, Ficus, Lagunaria, Laurus, Magnolia, Persea americana, Rhapis, Rosa, Rubus, Taxus, Viburnum,* and *Vitis.*

Discussion:

This species is closely allied to *Aspidiotus hederae* (Vallot) but differs from it in the longer dorsal ducts and the very small anal opening located near the median lobe basal scleroses. *A. hederae* has dorsal ducts which are noticeably short and rather broad, and the anal opening is large and removed by approximately four times its diameter from the apices of the median lobe basal scleroses.

On Coronado Island in San Diego County this species thrives very well out-of-doors, and infests many plants. Sometimes it is found in nurseries, and when discovered is the subject of eradication.

California records:

Los Angeles Co.: Gardena, III-4-42. Los Angeles, II-3-37 (L. E. Myers). Pasadena, I-26-32 (A. Toyne).

San Diego Co.: Coronado, VI-17-47 (R. W. Harper and K. H. Baker). San Diego, VI-16-49 (R. W. Harper and K. H. Baker).

Chortinaspis consolidata Ferris
Grass scale
(Fig. 17)

Chortinaspis consolidata Ferris, 1941, Atlas of Scale Insects, Ser. III:338.

Chortinaspis consolidata Ferris, 1946, Microentomology, 11(1):39.

Type locality: Near Old Woman Springs, San Bernardino County, California.

Type host: *Hilaria rigida,* grass.

Relation to host: According to Ferris (1941), "Occurring on the stem, more or less concealed beneath the coating of tomentum. Scale of the female white, somewhat convex, oval, with exuviae toward one end, ventral scale thin. Scale of the male white, elongate, with the exuvia apical."

Additional hosts: *Hilaria* sp.

Discussion:

This is the only species in this genus which at present is known to occur in California. According to Ferris (1941) it "is an extraordinary species which might well be seized upon as the type of a new genus. Nevertheless, the author adopts the view that it should for the present, at least, be referred to *Chortinaspis* and that to name a new genus for it is to obscure its relationships."

California records:

San Bernardino Co.: Between Box S and Old Woman Springs, III-19-39 (G. F. Ferris).

Chrysomphalus bifasciculatus Ferris
Bifasciculate scale
(Pl. 1, top row, right; fig. 18)

Chrysomphalus ficus Ashmead (=*aonidum* Linnaeus), Ferris, 1937, Microentomology, II(2):50-53, illus. (misidentification.)

Chrysomphalus bifasciculatus Ferris, 1938, Atlas of Scale Insects, Ser. II:199.

Chrysomphalus bifasciculatus Ferris, McKenzie, 1939, Microentomology, 2(2):57, illus.

Type locality: Pasadena, Los Angeles County, California, at the Huntington Gardens.

Type host: *Aspidistra* sp., aspidistra.

Relation to host: Occurring on the leaves. Scale of the female dark chocolate brown, with subcentral exuviae somewhat lighter; that of the male similar in color, oval, the exuvia toward one end.

Additional hosts: In addition to *Aspidistra* sp. the scale is recorded by McKenzie (1944) as occurring on: *Ampelopsis tricuspidata, Aralia, Aucuba japonica, Camellia japonica, Catha edulis, Cinnamomum camphora, Citrus, Cylas revoluta. Cyperus alternifolius, Elaeagnus, Euonymus* spp. *Ficus* spp., *Hakea saligna, Hedera helix, Ilex aquifolium, Laurus nobilis, Libertia, Ligustrum japonicum, Mondo, Nerium oleander, Olea, Phoenix canariensis, Pittosporum, Prunus ilicifolia, Prunus laurocerasus, Raphiolepis, Rhus,* and *Strelitzia reginae.*

Discussion:

This species appears to be rather generally distributed throughout California. It is interesting to note that the scale is apparently quite omnivorous in its feeding habits and occurs on many hosts both in nurseries and out-of-doors. Infestations of *C. bifasciculatus* on *Hedera helix* and *Euonymus* sp. (both plants growing out-of-doors) may be severely damaged as a result of the feeding of this insect.

This species has been in the past misidentified as *Chrysomphalus ficus* Ashmead (=*aonidum* Linneaus) and probably stands in many collections

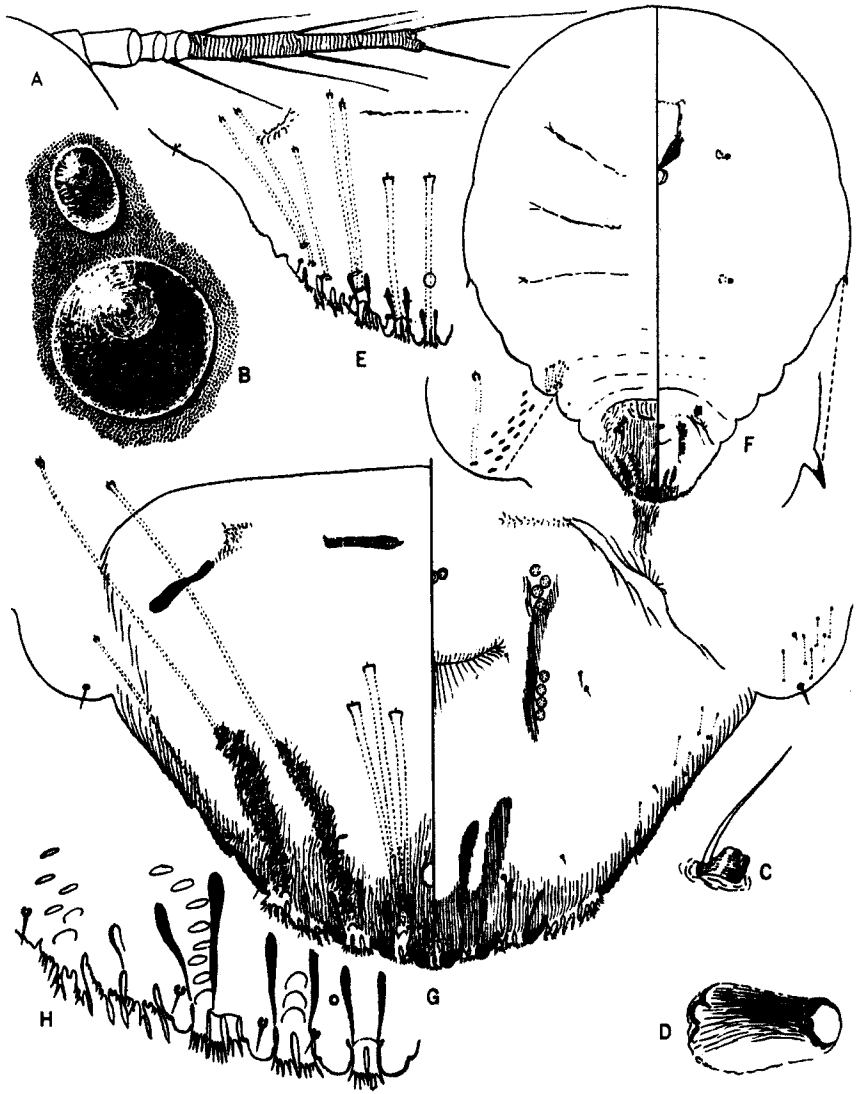

Fig. 18. *Chrysomphalus bifasciculatus* Ferris, bifasciculate scale.

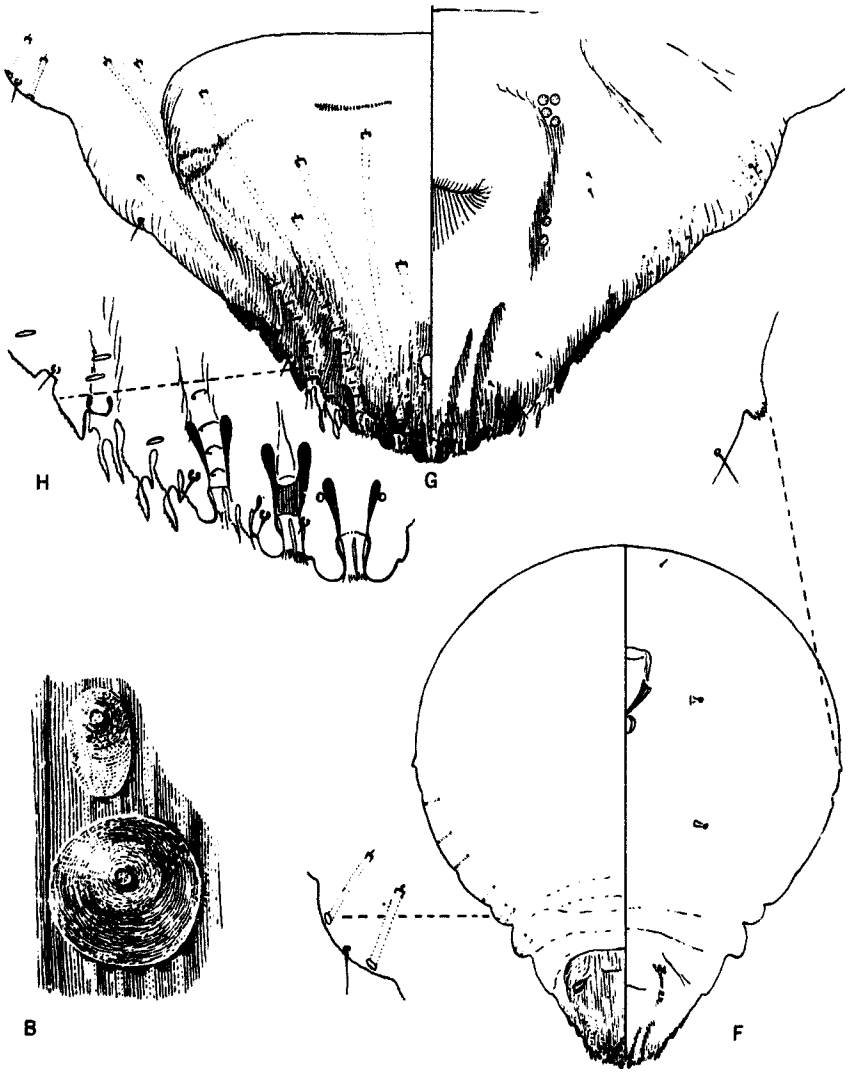

Fig. 19. *Chrysomphalus dictyospermi* (Morgan), Dictyospermum scale.

under this name. The presence of bundles of submarginal dorsal ducts on two prepygidial abdominal segments, instead of upon but one as in *ficus*, affords an instant means of separating the two.

California records:

Alameda Co.: Berkeley, IX-15-41 (M. R. Bell.

Butte Co.: Oroville, IV-10-41 (J. W. Dixon).

Fresno Co.: Fresno, VII-21-39 (T. B. Gallion).

Kern Co.: Bakersfield, I-25-39 (J. B. Steinweden).

Los Angeles Co.: Alhambra, VII-10-39. Belvedere Gardens, IV-14-39. Eagle Rock, IV-3-39 (M. R. Bell). Gardena, II-24-39. Glendale, III-14-39 (M. R. Bell). Harbor City, II-21-39 (M. R. Bell). Huntington Park, XI-12-41. Inglewood, III-10-39. Long Beach, XI-8-39 (C. R. Tower). Los Angeles, XII-20-39 (M. R. Bell). Monrovia, IX-13-39. Montebello, III-8-40 (C. R. Tower). Pasadena, (type lot) III-12-35 (H. L. McKenzie). San Pedro, IV-5-39. Van Nuys, III-11-41.

Marin Co.: San Rafael, X-25-40 (F. J. March).

Orange Co.: Garden Grove, III-24-41 (K. D. Sloop). Orange, VI-13-41 (C. R. Tower). Santa Ana, VI-5-40 (C. E. Norland).

Riverside Co.: Arlington, X-14-42 (C. E. Ehmann). Banning, VIII-28-42 (C. R. Tower). Palm Springs, X-13-43 (W. J. Cardier).

Sacramento Co.: Sacramento, V-5-53 (E. T. Gammon).

San Bernardino Co.: Redlands, V-4-43 (C. E. Ehmann). San Bernardino, X-6-41 (C. R. Tower). Upland, VII-16-41 (C. R. Tower).

San Diego Co.: Coronado, I-13-44 (Weimer and Prole). San Diego, VI-24-42 (C. R. Tower). Vista, III-29-39 (R. R. McLean).

San Francisco Co.: San Francisco, VIII-12-40 (F. J. March).

San Joaquin Co.: Lodi, III-10-43 (J. W. Dixon and J. B. Steinweden). Stockton, III-25-42 (M. A. Huberty).

San Luis Obispo Co.: San Luis Obispo, II-19-41, (R. M. Drake).

San Mateo Co.: Colma, X-8-40 (F. J. March). San Carlos, X-2-40 (F. J. March).

Santa Barbara Co.: Summerland, I-13-41 (F. J. March).

Santa Cruz Co.: Santa Cruz, VII-27-43 (M. R. Bell).

Solano Co.: Vallejo, XII-1-53 (L. A. Black).

Stanislaus Co.: Modesto, II-10-44 (F. E. Hayes). Turlock, II-20-40 (J. W. Dixon).

Ventura Co.: Ojai, I-20-42 (R. A. Young). Oxnard, VI-2-39 (R. A. Young).

Yolo Co.: Woodland, I-30-41 (E. E. Fix).

Chrysomphalus dictyospermi (Morgan)
Dictyospermum scale
(Fig. 19)

Aspidiotus dictyospermi Morgan, 1889, Ent. Mon. Mag., 25:352, illus.

Aspidiotus mangiferae Cockerell, 1893, Jour. Inst. Jamaica, 1:255.

Aspidiotus dictyospermi variety *jamaicensis* Cockerell, 1893, Canad. Ent., 26:129.

Aspidiotus dictyospermi variety *arecae* Newstead, 1893, Ent. Mon. Mag., 29:185.

Chrysomphalus minor Berlese and Leonardi, 1896, Riv. Patol. veg., 4:346.

Aspidiotus agrumincola Gregorio, 1915, Nat. sicil., 22:125.

Chrysomphalus castigatus Mamet, 1936, Proc. Roy. Ent. Soc. London, Ser. B, 5:94.

Chrysomphalus dictyospermi (Morgan), Ferris, 1938, Atlas of Scale Insects, Ser. II:200.

Chrysomphalus dictyospermi (Morgan), McKenzie, 1939, Microentomology, Part 2, 4(2):57-58.

Type locality: Demerara, British Guiana.

Type host: *Dictyosperma* sp., palm.

Relation to host: Occurring chiefly on the leaves. Scale of the female flat, quite thin, of a pale reddish-brown color, the area of the second exuvia being slightly paler than the remainder, the first exuvia forming a nipplelike prominence which is white in unrubbed specimens; scale of the male similar to that of the female in color, slightly elongate, with the exuvia near one end.

Additional hosts: Recorded from a long list of hosts, especially palms. Some of the infested hosts in California include: *Acacia, Acer palmatum, Annona cherimola, Anthericum, Aspidistra, Cactus, Camellia japonica, Citrus, Cocos, Elaeagnus, Epidendrum tampens, Euonymus, Ficus elastica, Ficus* (fig), *Hedera helix, Heliconia rex, Jasminum, Kentia, Laurus nobilis, Myrtus, Nerium oleander, Odontoglossum, Ophiopogon, Pandanus, Persea americana, Phoenix canariensis, Rosa, Salix, Strelitzia reginae,* and *Taxus.*

Discussion:

The synonymy as given above is that which is quite generally accepted. Only principal references have been cited. The view is here adopted that *Chrysomphalus pinnulifer* (Maskell) and *C. diversicolor* (Green), which have been placed as "varieties" of *dictyospermi*, or united with the latter, are distinct species.

The strongly clavate appendages of the two pygidial plates beyond the third lobe and the lack

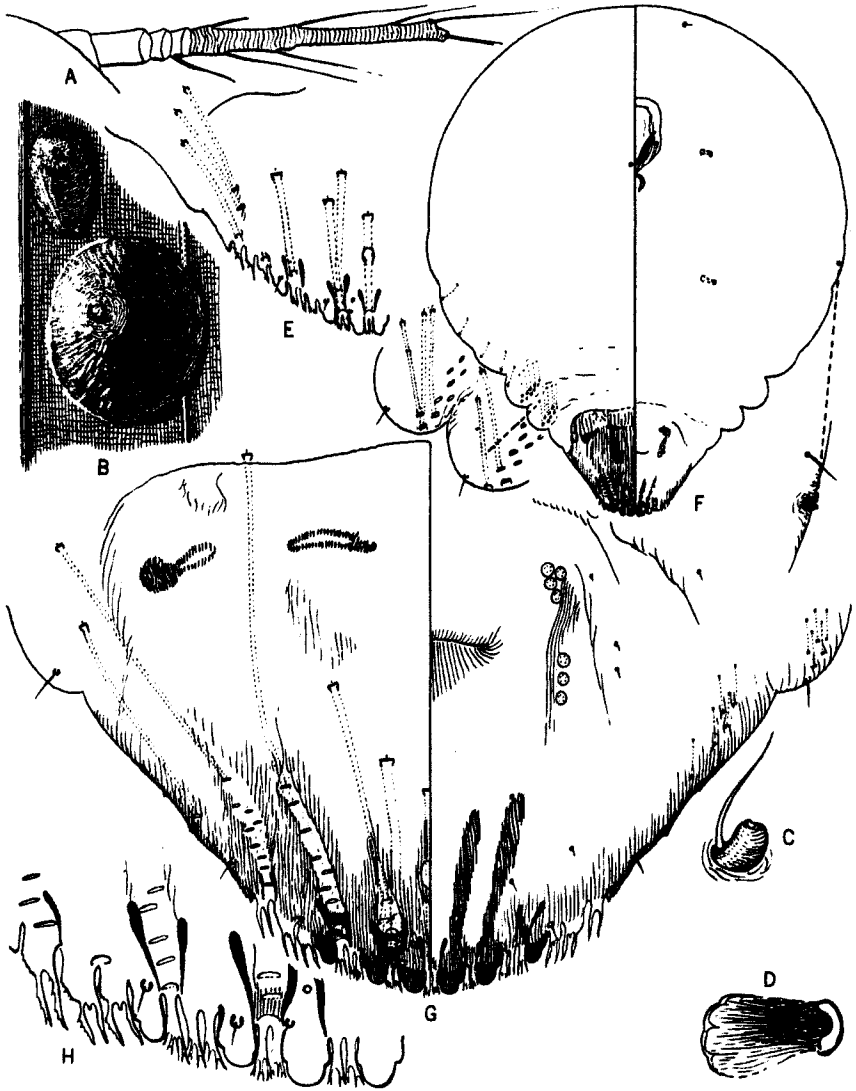

Fig. 20. *Chrysomphalus ficus* Ashmead, Florida red scale.

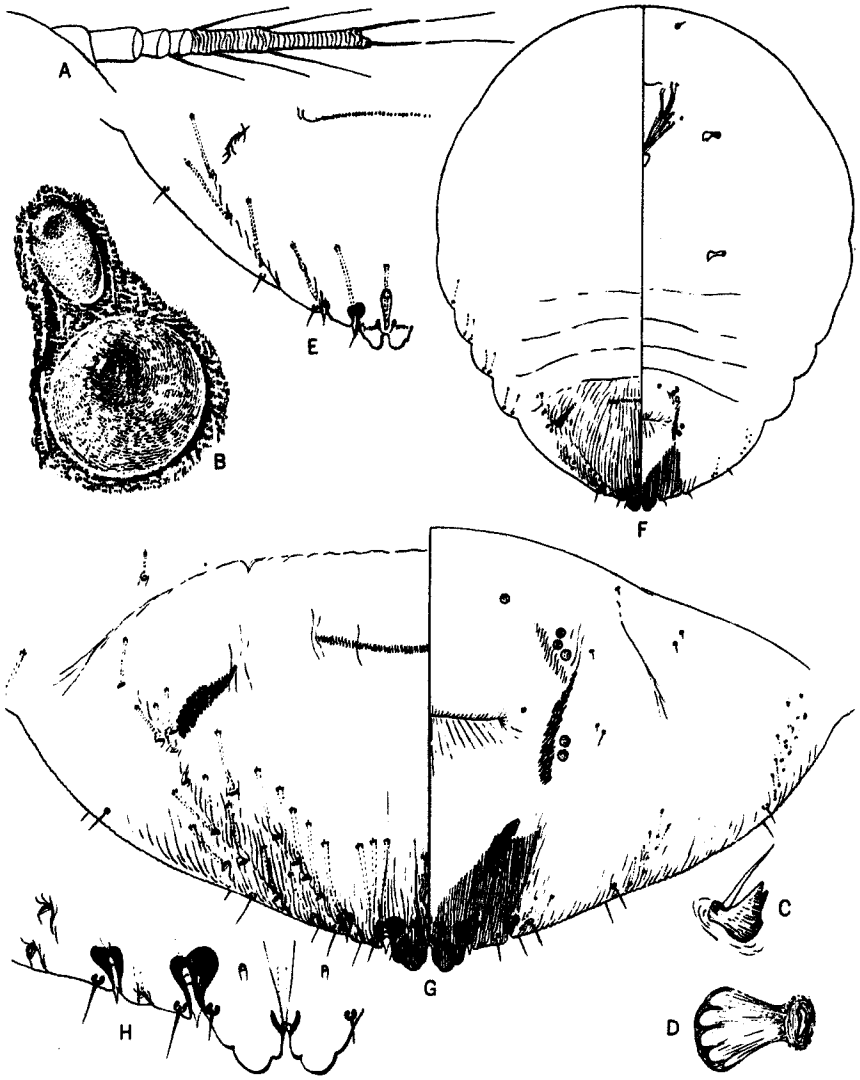

Fig. 21. *Clavaspis covilleae* (Ferris), Covillea scale.

of submarginal clusters of duct tubercles on the prepygidial abdominal segments distinguishes this species from the other two California species, *Chrysomphalus bifasciculatus* Ferris and *C. ficus* Ashmead.

California records:

Butte Co.: Chico, X-26-38 (R. Swett).

Los Angeles Co.: Los Angeles, IV-6-40 (R. M. Hawthorne). Montebello, I-8-32 (A. T. McClay). Santa Monica, II-23-33 (F. Wilson). Van Nuys, III-10-39 (M. R. Bell).

Marin Co.: San Rafael, XII-22-43 (M. R. Bell).

Orange Co.: Anaheim, VII-27-38 (T. B. Gallion). Santa Ana, XI-17-38 (C. E. Norland).

Riverside Co.: Riverside, X-20-42 (C. E. Ehmann).

Sacramento Co.: Sacramento, XI-24-31 (J. E. Bachman).

San Bernardino Co.: Ontario, II-8-32.

San Diego Co.: El Cajon, IX-23-36 (J. O. Brodeur). San Diego, XII-5-40 (R. R. McLean).

San Francisco Co.: San Francisco, VIII-29-38 (F. J. March).

San Joaquin Co.: Stockton, XI-20-28 (E. L. Smith).

San Mateo Co.: Colma, X-9-33 (F. J. March). San Bruno, IX-17-43 (R. H. Smith).

Ventura Co.: Newbury Park, I-4-39 (R. A. Young). Oxnard, III-18-32 (Stratton). Santa Paula, XI-27-42 (J. S. Schall). Saticoy, IX-16-31 (F. L. Smith).

Chrysomphalus ficus Ashmead
Florida red scale
(Fig. 20)

Chrysomphalus ficus Ashmead, 1880, Amer. Ent., 3:267.

Aspidiotus ficus Riley MSS [*sic*], Comstock, 1881, Rep. U.S.D.A. for 1880, p. 445.

Chrysomphalus aonidum (Linnaeus), Cockerell, 1899, Proc. Acad. Nat. Sci. Phila., p. 273.

Chrysomphalus aonidum (Linnaeus), Fernald, 1903, Catalogue of Coccidae, p. 286.

Chrysomphalus ficus Ashmead, Ferris, 1937, Microentomology, 3:105, illus.

Chrysomphalus ficus Ashmead, Ferris, 1938, Atlas of Scale Insects, Ser. II:201.

Chrysomphalus ficus Ashmead, McKenzie, 1939, Microentomology, 4(2):59-60, illus.

Type locality: Orlando, Florida.

Type host: *Citrus sinensis,* orange.

Relation to host: A leaf- and fruit-infesting species. Scale of the female variable in color, but tending to be quite dark brown or blackish, flat, circular, the exuviae central and paler than the remainder; scale of the male similar to that of the female in color, oval, exuvia near one end.

Additional hosts: Since this species was described, it has been recorded from an endless series of hosts in all parts of the world, out-of-doors in tropical and subtropical regions and under glass in colder areas. It is, however, entirely possible that many of the published records refer to other species, especially *Chrysomphalus bifasciculatus* Ferris, since it is known that these two species have been confused.

A few of the California hosts include: *Areca, Aspidistra, Camellia japonica, Citrus, Cocos nucifera, Cordyline, Cycas, Cypripedium, Euonymus, Erythrina crista-galli, Ficus doescherii, Ficus elastica, Gardenia, Hedera helix, Ilex cornuta, Jasminum, Kentia fosteri, Mangifera indica, Mondo, Nerium oleander, Odontoglossum Osmanthus fragrans, Pandanus veitchi, Persea americana, Phoenix humilis loureiri, Pothos aureus, Robinia, Sanseveria,* and *Viburnum.*

Discussion:

The synonymy indicated above is quite general; only principal references have been cited.

It may be worth while here to explain a bit of the nomenclatorial history of this species. Apparently the first published information concerning it was presented by Ashmead in 1879 in the *Florida Agriculturist.* He published further notes on it in the *Pacific Rural Press* in 1880. Neither of these journals is to be considered as a scientific publication, and consequently the name cannot be regarded as validly published by appearing in either of them. In 1880 Ashmead presented what may be regarded as a scientific description of the insect in a scientific journal, *The American Entomologist,* and the name may be accepted as of that date. Each time Ashmead ascribed both the generic and specific names to Riley, who had used them in manuscript notes.

It seems clear that under the accepted rules of nomenclature, it was Ashmead who first published these names in connection with an indication or a description and that Riley had nothing to do with this publication. Ashmead quoted Riley as saying that he had the species from *Ficus nitida,* but without an indication of locality. Ashmead's own specimens seem to have come from orange at Orlando, Florida, and this may be regarded as the type host and locality.

I (1939) have previously pointed out that the displacement of the name *ficus* by an attempt to identify this species with the *Coccus aonidum* of Linnaeus, a step which was proposed in 1899,

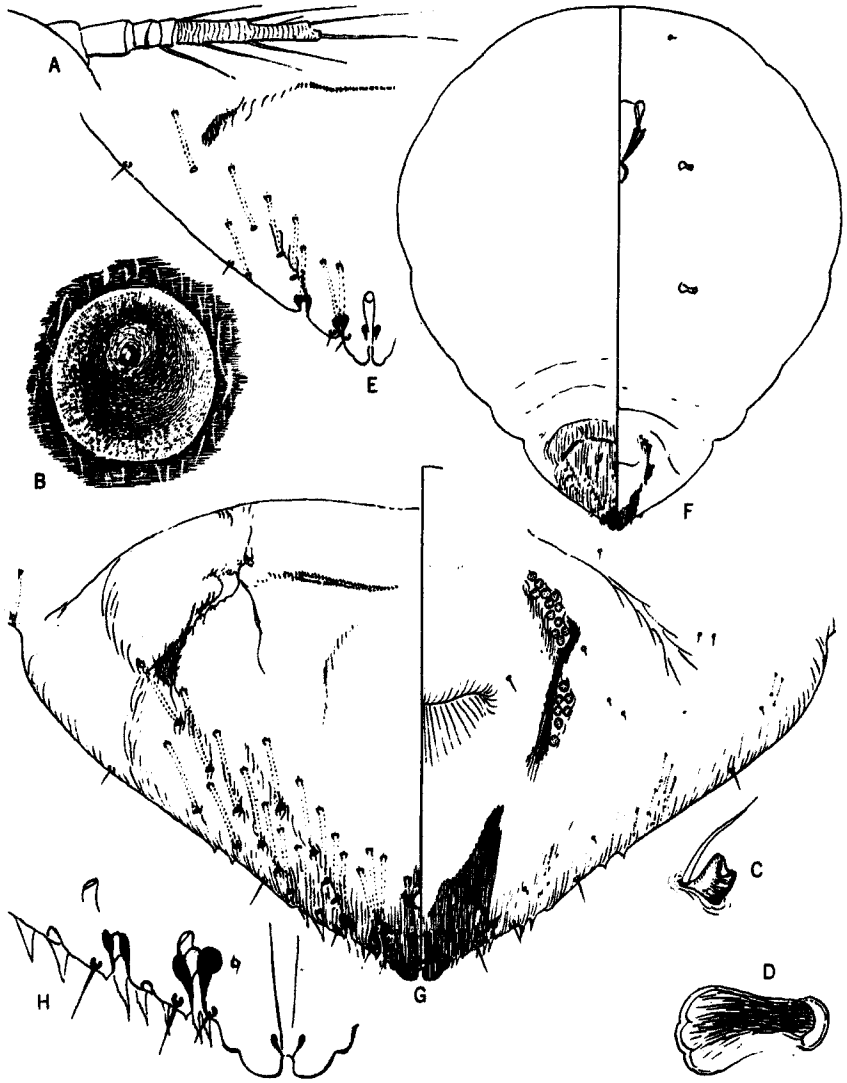

Fig. 22. *Clavaspis disclusa* Ferris, discluse scale.

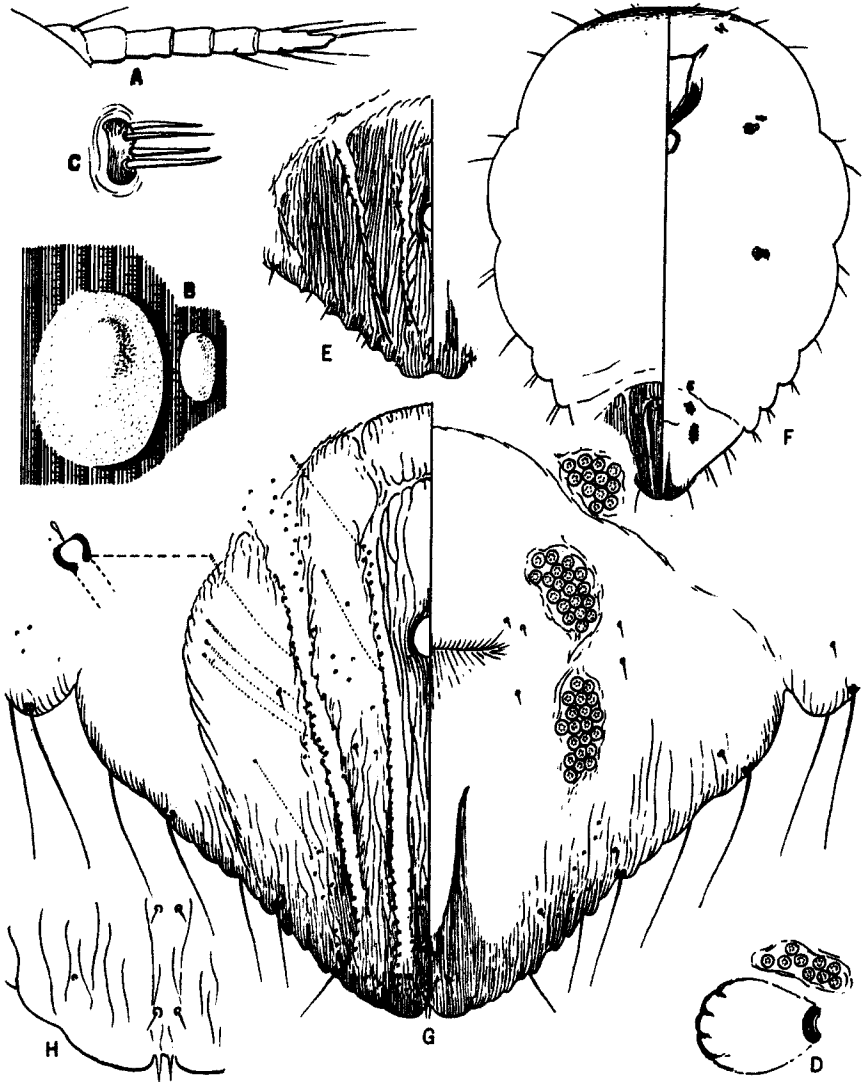

Fig. 23. *Comstockiella sabalis* (Comstock), palmetto scale.

was unjustified; the Linnaean species was entirely unrecognizable.

Although it is definitely known that this species has been confused with *Chrysomphalus bifasciculatus* Ferris, it is readily separable from the latter, and from all other known species of the genus, by the conspicuous cluster of submarginal, dorsal ducts on only the second abdominal segment.

California records: A few of the California locality records in the California State Department of Agriculture collection include:

Alameda Co.: Berkeley, IX-22-41 (M. R. Bell). Oakland, X-10-28 (F. J. March). San Leandro, XII-29-41 (M. R. Bell).

Fresno Co.: Fresno, V-5-39 (T. B. Gallion).

Los Angeles Co.: Avalon, X-14-36 (V. E. Williams). Beverly Hills, XII-10-35 (V. E. Williams). Compton, VIII-25-39 (C. R. Tower). Gardena, VII-6-36 (V. E. Williams). Long Beach, IX-23-38. Moneta, VI-27-35 (V. E. Williams). Montebello, VII-15-31 (A. C. Browne). San Gabriel, VI-29-32 (B. Turner). South Pasadena, VIII-6-36 (V. E. Williams).

Monterey Co.: Salinas, VI-23-50.

Orange Co.: Anaheim, I-3-48.

Sacramento Co.: Sacramento, III-6-29 (E. A. Wilkins).

San Bernardino Co.: Ontario, VII-14-41 (C. R. Tower).

San Francisco Co.: San Francisco, X-10-28 (F. J. March).

San Joaquin Co.: Stockton, III-25-41 (J. W. Dixon).

San Mateo Co.: Colma, X-9-33 (F. J. March and W. C. Baker).

Santa Barbara Co.: Carpenteria, XI-9-44 (M. E. Cravens). Montecito, XI-7-36 (W. S. Cummings).

Santa Clara Co.: Palo Alto, VII-23-40 (F. J. March). San Jose, VII-8-40 (F. J. March).

Santa Cruz Co.: Capitola, XI-27-43 (M. Mello).

Solano Co.: Fairfield, XII-17-40 (F. J. March).

Stanislaus Co.: Modesto, V-6-31.

Tulare Co.: Exeter, V-18-43 (J. A. Awbrey).

Ventura Co.: Ojai, IX-19-33.

Yuba Co.: Marysville, XI-17-43 (A. W. Worledge).

Clavaspis covilleae (Ferris)
Covillea scale
(Fig. 21)

Aspidiotus covilleae Ferris, 1919, Stanford Univ. Publ., Univ. Ser., pp. 64-65, illus.

Ferrisaspis covilleae (Ferris), MacGillivray, 1921, The Coccidae, pp. 422-423.

Clavaspis covilleae (Ferris), 1938, Atlas of Scale Insects, Ser. II:204.

Type locality: Mormon Flat, near Tucson, Arizona.

Type host: *Larrea tridentata* (=*Covillea glutinosa*), creosote bush.

Relation to host: According to Ferris (1938) the types of this species were taken from beneath loose bark on exposed roots. The specimens from olive occur on the twigs. Scale of the female flat, circular, whitish, exuviae subcentral; scale of the male elongate, oval, with exuvia near one end.

Additional hosts: *Acacia paucispina, Euonymus, Forchhammeria, Olea europeae, Pluchea sericea, Prunus amygdalus, Pyrus communis,* and *Rhus trilobata.*

Discussion:

This species differs from the other California form, *Clavaspis disclusa* Ferris, in fewer perivulvar pores (not more than two or three in any one group) as compared to at least six in *disclusa,* and in the broader, less acute-shaped pygidium.

California records:

Imperial Co.: El Centro, IV-9-45 (C. G. Anderson and A. J. Hanson).

Riverside Co.: Banning, I-2-47 (C. Cordill). Barnwell, 1940 (G. F. Ferris). Mecca, XII-1923 (B. Boyer and H. Blom).

Clavaspis disclusa Ferris
Decluse scale
(Fig. 22)

Clavaspis disclusa Ferris, 1938. Atlas of Scale Insects, Ser. II:205.

Type locality: Camarillo, Ventura County, California.

Type host: *Juglans regia,* Persian walnut.

Relation to host: Occurring on the bark. Adult female scale dark gray, flat, circular, exuviae central almost entirely concealed; scale of the male not described.

Additional hosts: *Carya illinoensis, Cornus, Fraxinus, Juglans californica, Juglans* sp. (*Butternut*), *Prunus persica,* and *Quercus.*

Discussion:

This species may be distinguished from *Clavaspis covilleae* (Ferris) by the more numerous perivulvar pores (at least six pores in any one group) as compared to only two or three in *covilleae,* and in a more acute-shaped pygidium.

California records:

Los Angeles Co.: San Marino, VI-15-48 (R. W. Harper).

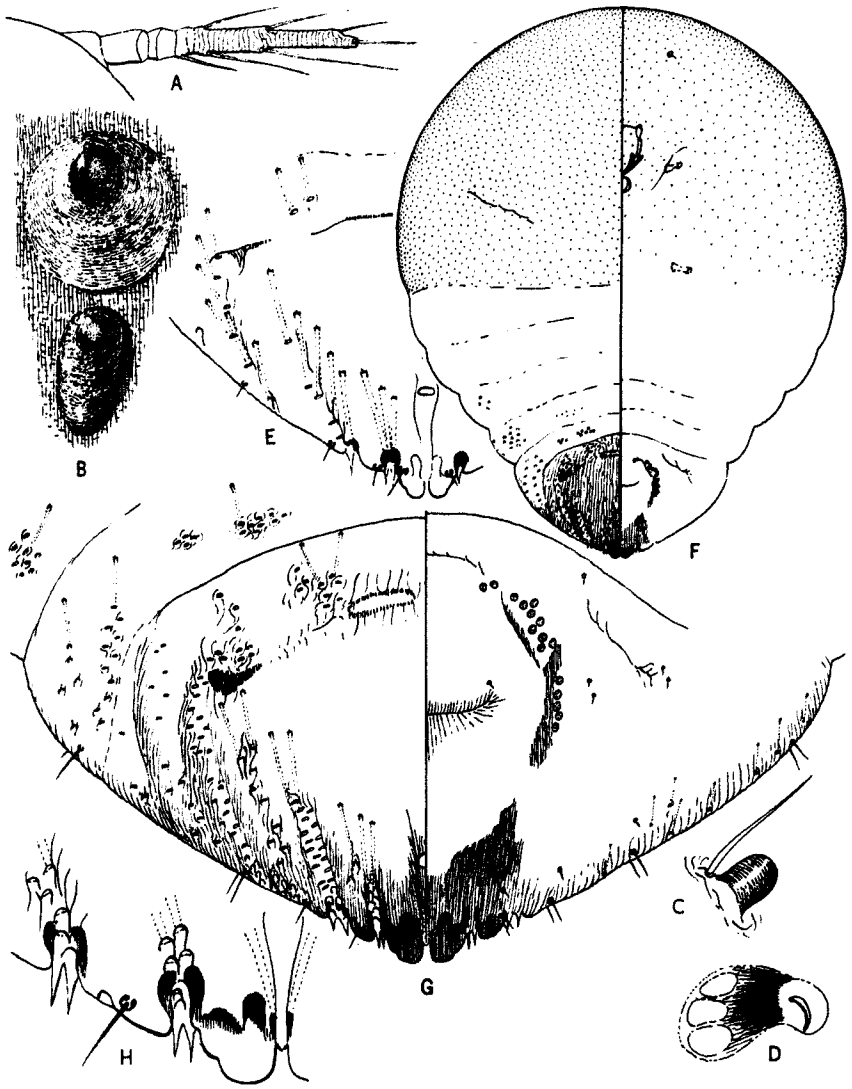

Fig. 24. *Diaspidiotus aesculi* (Johnson), buckeye scale.

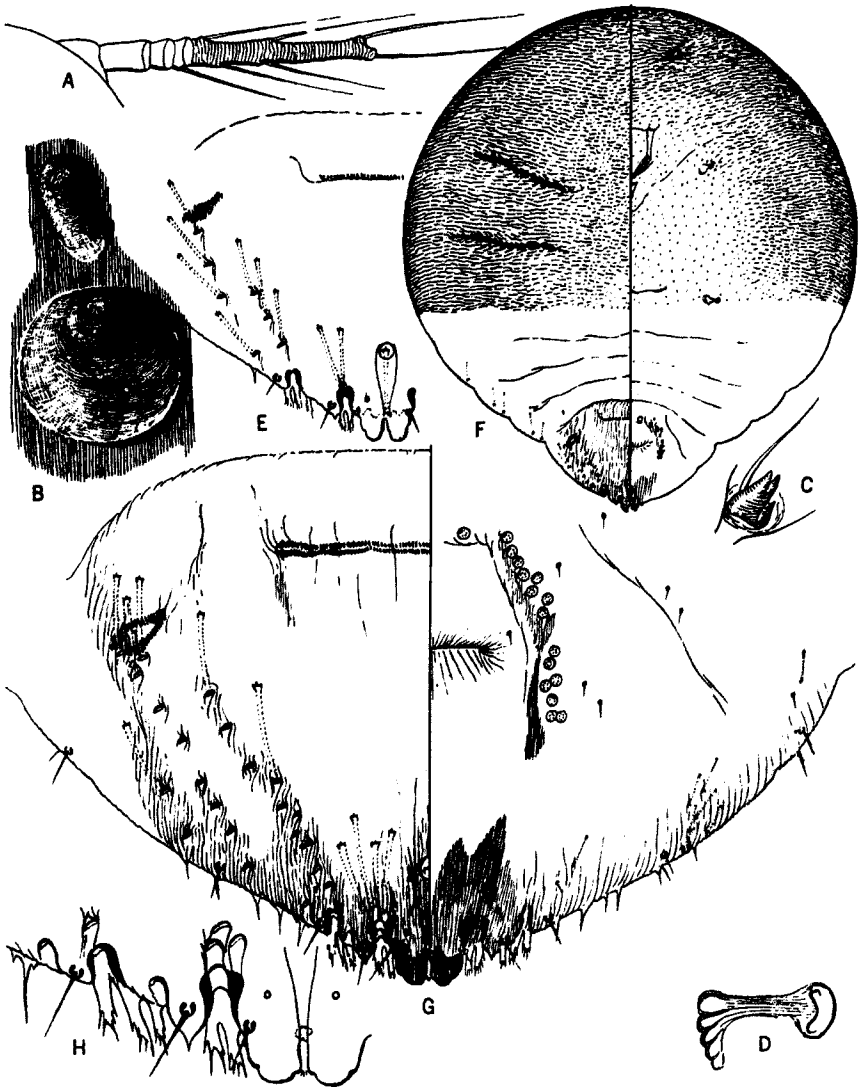

Fig. 25. *Diaspidiotus ancylus* (Putnam), Putnam scale.

Orange Co.: Fullerton, XI-26-47 (R. J. Bumgardner). Orange, VII-7-38 (C. E. Norland). Santa Ana, XI-14-47 (D. H. Byers).

Placer Co.: Tahoe City, VIII-26-35 (A. C. Fleury).

Riverside Co.: Riverside, IV-7-44 (D. H. Byers).

Sacramento Co.: Sacramento, IV-17-39 (Tofft).

San Bernardino Co.: Colton, I-22-48 (W. A. Burr).

San Diego Co.: Flynn Springs, VI-28-45 (G. Beevor).

San Joaquin Co.: Linden, XII-4-46 (W. W. Middlekauff). Stockton, III-20-41 (J. W. Dixon).

Tulare Co.: Exeter, II-18-48 (O. L. Hemphill). Farmersville, II-5-48 (T. B. Gallion, H. French, and J. B. Steinweden).

Ventura Co.: Camarillo, II-27-36 (E. L. Smith). Oxnard, XI-19-40 (L. E. Onstot). Saticoy, XI-26-41 (L. R. Gillogly).

Comstockiella sabalis (Comstock)
Palmetto scale
(Fig. 23)

Aspidiotus sabalis Comstock, 1883, 2d. Rep. Dept. Ent. Cornell Univ., 2:68.

Comstockiella sabalis variety *mexicana* Cockerell, 1899. Jour. N.Y. Ent. Soc., 7:257.

Comstockiella sabalis (Comstock), Smith, 1917, Mon. Bull., Calif. Comm. Hort., VI:6, p. 249.

Comstockiella sabalis (Comstock), Ferris, 1938, Atlas of Scale Insects, Ser. II:213.

Type locality: Fort George and Sanford, Florida.

Type host: *Sabal* sp., palmetto.

Relation to host: This scale infests the leaves, frequently in great numbers. Adult female scale white, oval, the exuviae subcentral and concealed by wax; scale of the male also white, elongate, and similar in form and texture to that of the adult female, exuvia hardly discernible.

Additional hosts: Recorded only from hosts which were identified merely as "palm" or "palmetto."

Discussion:

This scale was reported by Smith (1917) as heavily infesting a "palmetto" tree on the Wright Ranch near Riverside, California. Smith's record indicates the scale had been present on the tree for approximately fifteen years, and that even though more than 40 different varieties of palms were growing adjacent to the palmetto, the scale insect had not spread to the other palms. Apparently an attempt was made to eradicate the scale on the infested palmetto.

This species is readily identifiable since it lacks pygidial lobes, plates, or gland spines, or marginal scleroses, and its margins are merely crenulate. Ferris (1938) places the species in the Aspidiotini mainly because of the length and slenderness of the pygidial macroducts.

California records:

Apparently only two California records are available for *Comstockiella sabalis* (Comstock). It is recorded as follows:

Riverside Co.: Riverside (near), 1917 (G. F. Ferris).

Santa Barbara Co.: Montecito, VI-23-55 (G. Beevor).

Diaspidiotus aesculi (Johnson)
Buckeye scale
(Fig. 24)

Aspidiotus aesculi Johnson, 1896, Bull. Illinois Lab. Nat. Hist., 4:386.

Diaspidiotus aesculi (Johnson), Ferris, 1938, Atlas of Scale Insects, Ser. II:215.

Type locality: Stanford University, Santa Clara County, California.

Type host: *Aesculus californica,* California buckeye.

Relation to host: Occurring on the bark. Apparently this scale is responsible for pitting of the bark. Female scale is gray, circular, quite flat, exuviae subcentral; scale of the male elongate, gray, exuvia near one end.

Additional hosts: *Acer negundo, Adelia neomexicana, Alnus, Arbutus menzezi, Fraxinus, Juglans californica, Juglans regiae, Populus fremontii, Populus trichocarpa, Populus* sp., *Sambucus glauca, Salix argentea, Syringa,* and *Quercus.*

Discussion:

This scale is recognizable from other California *Diaspidiotus* species mainly by the presence of dorsal submedian clusters of ducts on the first pygidial and on prepygidial segments, as well as numerous submarginal clusters of ducts on the pygidium and prepygidial segments. The species is especially associated with *Aesculus,* but also occurs on *Populus* and other hosts in California.

California records:

Butte Co.: Chico, III-8-34 (M. L. Jones).

El Dorado Co.: Placerville, II-15-31 (A. C. Browne).

Fresno Co.: Kingsburg, III-3-41 (O. L. Hemphill).

Inyo Co.: Lone Pine, IV-25-39 (J. W. Dixon).

Kings Co.: Hanford, IV-2-41 (T. B. Gallion).

Los Angeles Co.: Los Angeles, VIII-24-36 (L. E. Myers). San Fernando, IV-25-35 (I. C. Thomas).

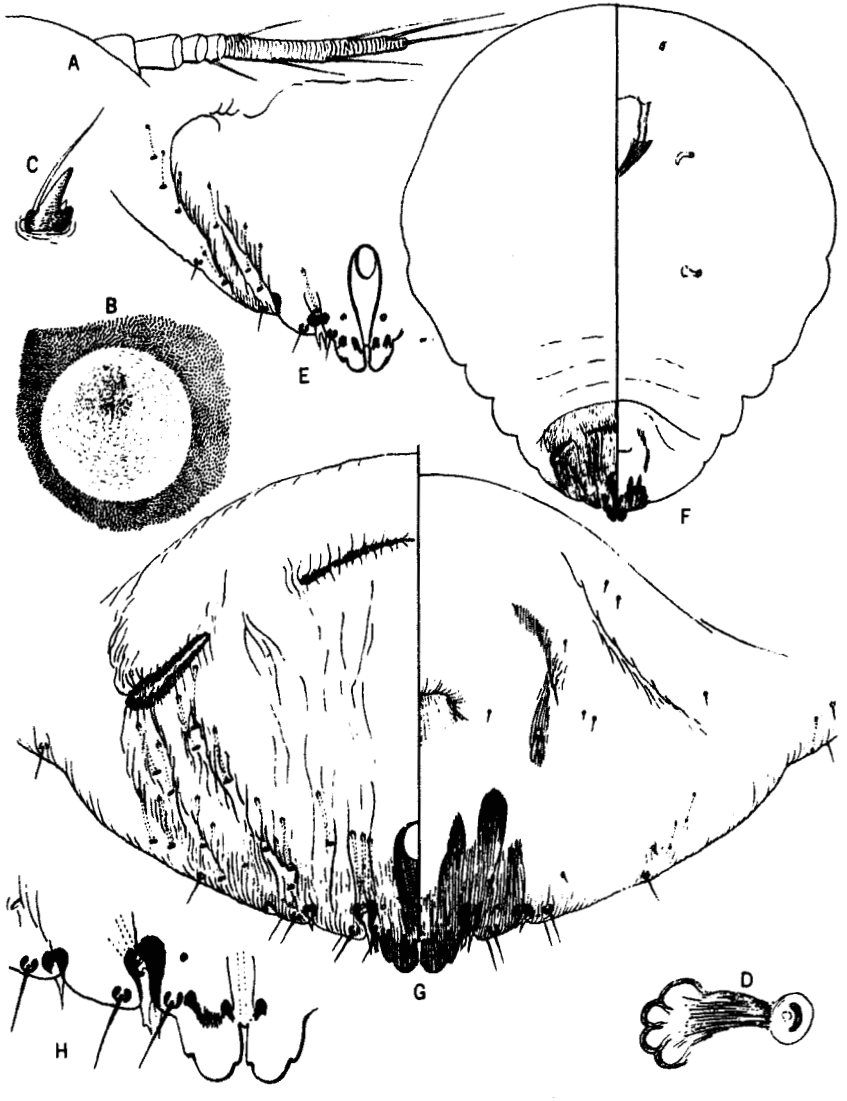

Fig. 26. *Diaspidiotus coniferarum* (Cockerell), conifer scale.

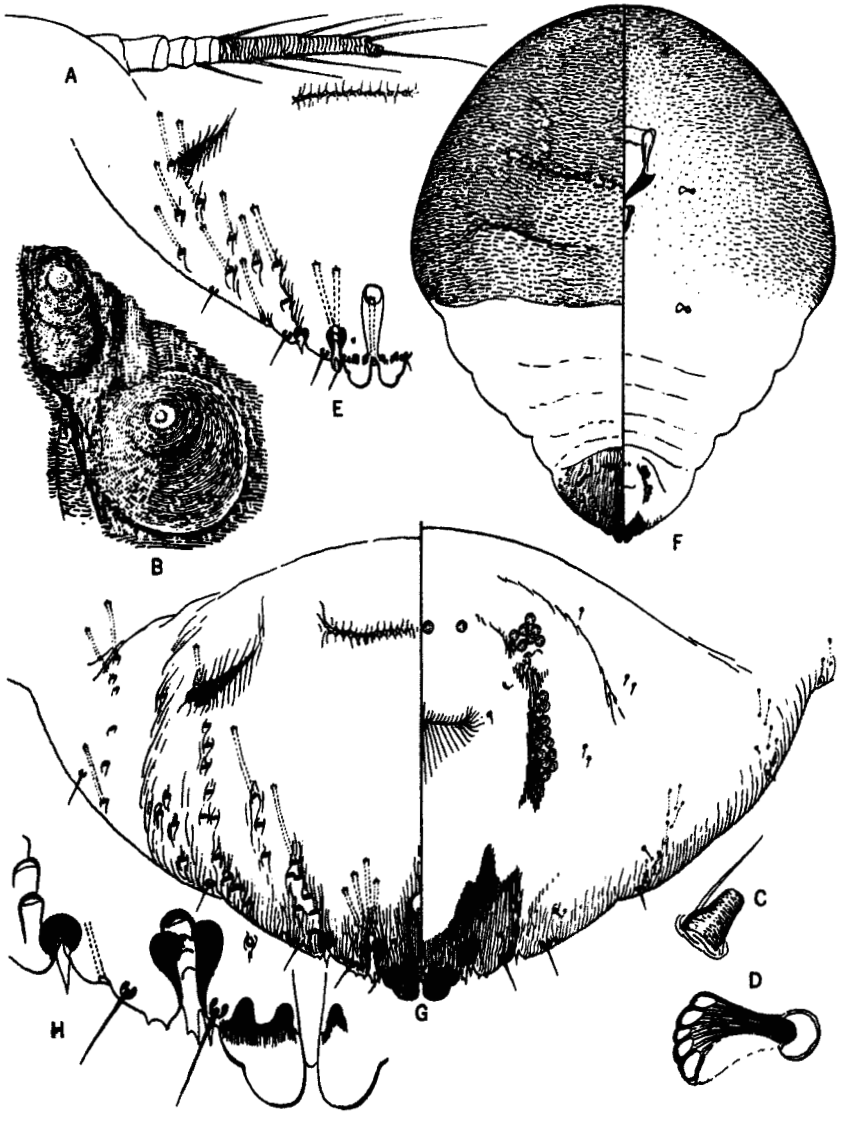

Fig. 27. *Diaspidiotus ehrhorni* (Coleman), Ehrhorn scale.

Madera Co.: Madera, XII-30-41 (T. B. Gallion and G. Beevor).

Merced Co.: Bear River Park, IX-8-47 (R. P. Allen). Dos Palos, VI-18-42 (McIntyre). Gustine, II-18-41 (A. J. Dunlap). Merced Falls, VIII-19-42 (E. C. McDaniel).

Monterey Co.: Kings City (G. F. Ferris).

Orange Co.: Santiago Creek, III-1-37 (C. E. Norland).

Sacramento Co.: Folsom, V-23-44 (Evans). Sacramento, II-12-41 (J. B. Steinweden).

San Diego Co.: Flynn Springs, VI-23-34 (E. T. Gammon and C. Gammon).

Santa Barbara Co.: Cuyama Valley (G. F. Ferris).

Santa Cruz Co.: Santa Cruz, IV-1920 (G. F. Ferris).

Stanislaus Co.: Modesto, I-27-44 (E. C. McDaniel).

Tehama Co.: Corning, IV-28-53 (S. T. Ancell).

Tulare Co.: Visalia, X-1931 (O. L. Hemphill).

Ventura Co.: Bardsdale, III-6-34 (E. L. Smith). Camarillo, IV-12-35 (L. T. Stratton). Conejo Creek, IV-29-40 (J. L. Schall). Santa Rosa Valley, IV-29-40 (J. L. Schall). Santa Susana, IV-20-33 (W. M. Dunning). Simi, III-15-35 (E. L. Smith).

Yolo Co.: Winters, IV-23-47 (J. Vettel). Woodland, VI-27-38 (C. H. Hardy); IV-1-47 (T. E. Collister).

Diaspidiotus ancylus (Putnam)
Putnam scale
(Pl. 1, bottom row, left; fig. 25)

Diaspis ancylus Putnam, 1877, Trans. Iowa Hort. Soc., 12:321.

Aspidiotus ancylus Putnam, 1879, Proc. Davenport Acad. Nat. Sci., 2:346.

Aspidiotus ancylus variety *serratus* Newell and Cockerell, 1898, Iowa Acad. Sci., 5:229.

Aspidiotus ancylus variety *latilobis* Newell, 1899. Contr. Dept. Ent. Iowa Agric. Coll., 3:9.

Aspidiotus aesculi subspecies *solus* Hunter, 1899, Kans. Univ. Quart., 8:12.

Aspidiotus (Diaspidiotus) obioensis York, 1905, Ohio Nat., 5:325, illus.

Diaspidiotus solus (Hunter), MacGillivray, 1921, The Coccidae, p. 414.

Diaspidiotus obioensis (York), MacGillivray, 1921, The Coccidae, p. 412.

Aspidiotus oxycrataegi Hollinger, 1923, Bull. Miss. Agric. Expt. Sta., 58:15.

Diaspidiotus ancylus (Putnam), Ferris, 1938, Atlas of Scale Insects, Ser. II:216.

Type locality: Davenport, Iowa.

Type host: *Acer saccharum*, sugar maple.

Relation to host: Occurring on the bark. Scale of the female dark gray, circular, quite convex, exuvia near one end; male scale elongate, gray, exuvia toward one end.

Additional hosts: This species is quite omnivorous in its feeding habits. The following list includes many of the hosts from which it has been taken: *Betula, Carya illinoensis, Catalpa, Celtis occidentalis, Cephalanthus occidentalis, Crataegus, Cydonia, Fagus, Fraxinus, Hicoria pecan, Hydrangea quercifolia, Juglans nigra, Juglans regiae, Juglans* sp., *Liriodendron tulipifera, Maclura pomifera, Malus pumila, Malus* sp., *Olea europeae, Populus candicans, Prunus amygdalus, Prunus armeniaca, Prunus persica, Prunus* sp., *Pyrus communis, Quercus wislizeni, Ribes, Robinia hispida, Salix, Sorbus americana, Tilia,* and *Ulmus.*

Discussion:

According to Ferris (1938), "This species is one of a group of very closely similar forms and it is quite possible that detailed study of large quantities of material, especially if supplemented by biological experiment, will lead to conclusions other than those here presented concerning these species."

Typical specimens are represented by the complete absence of dorsal ducts anterior to the fifth segments of abdomen, this being combined with moderately large and fimbriate plates. I have seen California specimens which vary slightly from typical *ancylus*, thus making a positive decision most difficult. The extended synonymy previously recorded is further indication of the confusion that has existed in the past. Several collected lots of material belonging to the "ancylus group" are not here included but have been set aside for future taxonomic study.

Diaspidiotus ancylus (Putnam) is very closely related to *Diaspidiotus uvae* (Comstock), differing from the latter in having a darker scale covering and less prominent median pygidial lobes with a plate between them. The dorsal pygidial macroducts are broader, less slender than in typical *uvae.*

California records:

Butte Co.: Chico, I-3-37 (W. Wheeler).

El Dorado Co.: Placerville, II-15-31 (A. C. Browne).

Kern Co.: Bakersfield, VII-18-43 (M. R. Bell).

Los Angeles Co.: Compton, I-4-44 (D. H. Byers and Cameron). Little Rock, VIII-12-46.

Orange Co.: Fullerton, III-30-44 (R. J. Bumbardner). Orange, VII-7-38 (C. E. Norland).

Riverside Co.: Hemet, VIII-15-46 (F. R. Platt and O. A. Eggen). Riverside, IV-7-44 (Cameron, Roof, and D. H. Byers). San Jacinto, XII-26-46 (R. P. Allen).

San Bernardino Co.: Ontario, V-5-53 (R. Gamblin and W. R. Young).

San Diego Co.: La Mesa, I-8-42 (D. F. Palmer). San Diego, XII-30-53 (R. J. Buckner).

San Joaquin Co.: Belloto, VI-24-47 (J. Solari). Linden, VI-20-47 (J. Solari). Stockton, II-19-47 (J. W. Dixon).

San Mateo Co.: Redwood City, X-13-53 (I. J. Campbell).

Stanislaus Co.: Riverbank, I-8-45 (Hayes).

Tehama Co.: Corning, IV-28-53 (S. T. Ancell).

Yolo Co.: Woodland, III-27-47 (E. T. Gammon).

Diaspidiotus conferarum (Cockerell)
Conifer scale
(Fig. 26)

Aspidiotus coniferarum Cockerell, 1898, Psyche, 8:201.

Comstockaspis coniferarum (Cockerell), MacGillivray, 1921, The Coccidae, p. 439.

Diaspidiotus coniferarum (Cockerell), Ferris, 1938, Atlas of Scale Insects, Ser. II:218.

Type locality: Organ Mountains, New Mexico.

Type host: *Pinus ponderosa* variety *scopulorum,* Rocky Mountain ponderosa pine.

Relation to host: Occurring on the bark of smaller limbs. Female scale whitish or gray, blending with the bark color, subcircular, flat, exuviae subcentral; male scale not observed.

Additional hosts: *Cupressus guadelupensis, Cupressus macrocarpa, Cupressus sargenti, Juniperus monosperma, Juniperus occidentalis, Juniperus pachyphloea, Juniperus virginiana, Libocedrus decurrens.*

Discussion:

This species is geographically quite widespread in California. It shares with *Diaspidiotus liquidambaris* (Kotinsky) the absence of perivulvar pores but differs from the latter in the paucity of pygidial plates and larger anal opening.

California records:

Alameda Co.: Cedar Mountain, XI-1920 (L. R. Abrams).

Amador Co.: River Pines, IX-27-53 (H. H. Keifer).

Kern Co.: Semmler, III-27-35 (G. F. Ferris).

Los Angeles Co.: Compton, VI-23-37 (V. E. Williams). Los Angeles, X-17-31 (G. R. Gorton). Montebello, 1-10-34 (C. R. Tower). North Hollywood, I-13-38 (V. E. Williams). Pasadena VIII-4-41.

Mariposa Co.: Crockers, VII-1918 (G. F. Ferris).

Modoc Co.: Indian Springs, 1938 (G. F. Ferris).

Riverside Co.: Hemet, IX-16-47 (R. W. Harper). Riverside, II-2-18 (A. F. Swain).

San Diego Co.: San Diego, II-9-44 (G. Beevor).

San Mateo Co.: Redwood City, IX-22-22 (A. E. Burks).

Santa Clara Co.: Stanford University, X-1918 (G. F. Ferris).

Siskiyou Co.: Mount Shasta, IX-4-01 (Coleman).

Ventura Co.: Simi, I-8-41 (R. L. Doutt).

Diaspidiotus ehrhorni (Coleman)
Ehrhorn scale
(Fig. 27)

Aspidiotus (Diaspidiotus) ehrhorni Coleman, 1903, Jour. N.Y. Ent. Soc., 11:68, illus.

Diaspidiotus ehrhorni (Coleman), Ferris, 1938, Atlas of Scale Insects, Ser. II:221.

Type locality: Near Sissons, Siskiyou County, California.

Type host: *Abies concolor,* white fir, and *Libocedrus decurrens,* California incense cedar.

Relation to host: Occurring on the bark, frequently concealed beneath lichens. Female scale gray, flat, circular, exuviae subcentral; scale of the male elongate oval, the exuvia near one end.

Additional hosts: *Pinus cembroides parryana, Pinus sabiniana, Pseudotsuga taxifolia.*

Discussion:

This species is comparatively rare in California, it being recorded from only five localities in the state. It most closely resembles *Diaspidiotus osborni* (Newell and Cockerell) but differs in possessing extra dorsal duct tubercles in the outer angle of the pygidium, and usually in having more numerous perivulvar pores.

California records:

Colusa Co.: Williams, IX-1939 (G. F. Ferris).

Riverside Co.: Tahquitz Peak, San Jacinto Mountains, 1912 (J. C. Bridwell).

San Diego Co.: Mount Laguna, VII-10-41 (D. DeLeon).

Santa Cruz Co.: Santa Cruz, XII-27-38 (F. J. March). Scott Creek (G. F. Ferris).

Diaspidiotus liquidambaris (Kotinsky)
Sweet gum scale
(Fig. 28)

Cryptophyllaspis liquidambaris Kotinsky, 1903, Proc. Ent. Soc. Wash., 5:149.

Chemnaspidiotus liquidambaris (Kotinsky), MacGillivray, 1921, The Coccidae, p. 439.

Diaspidiotus liquidambaris (Kotinsky), Ferris, 1938, Atlas of Scale Insects, Ser. II:223.

Type locality: Washington, D.C., and Atlanta, Georgia.

Type host: *Liquidambar styraciflua,* American sweetgum.

Relation to host: This is a most unusual scale insect. On the type host it causes the formation of leaf-pit galls, each gall being occupied by a single adult female scale. The opening inside the gall is filled with the female scale, and only the exuviae are visible from the underside of the leaf. Exposed exuviae of the female scale flat and white. Male scale exposed upon the leaves, white, elongate oval, with exuvia toward one end.

Additional hosts: In addition to *Liquidambar* the following hosts of this scale are recorded: *Acer rubrum* and *Acer* sp.

Discussion:

This scale is extremely rare in California having been found only in two localities, one a nursery infestation at Rivera, Los Angeles county, the other growing out-of-doors at Atwater in Merced County. The nursery infestation involved nine liquidambar trees which were subsequently destroyed. The Atwater infestation occurred on large roadside trees. Recent reports indicated these trees were removed for highway expansion. The species shares with *Diaspidiotus coniferarum* (Cockerell) the total absence of perivulvar pores on the pygidium. It differs from the latter mainly in the greater development of the pygidial plates and the smaller anal opening.

California records:

Los Angeles Co.: Rivera, VI-11-51 (L. E. Myers).

Merced Co.: Atwater, V-28-42 (E. T. Gammon and T. B. Gallion).

Diaspidiotus osborni (Newell and Cockerell)
Osborn scale
(Fig. 29)

Aspidiotus osborni Newell and Cockerell, 1898, Rep. Iowa Acad. Sci., 5:229.

Diaspis snowii Hunter, 1899, Kans. Univ. Quart., 8:14.

Aspidiotus yulupae Bremner, 1907, Canad. Ent., 39:67, illus.

Neosignoretia yulupae (Bremner), MacGillivray, 1921, The Coccidae, p. 424.

Diaspidiotus osborni (Newell and Cockerell), Ferris, 1938, Atlas of Scale Insects, Ser. II:224.

Type locality: Ames, Iowa.

Type host: *Quercus alba,* white oak.

Relation to host: Occurring on the bark of the host. Adult female scale gray or whitish, usually nearly the color of the bark, circular, flat; male scale elongate oval, exuvia near one end.

Additional hosts: *Carya illinoensis, Cornus nuttalli, Crataegus, Diospyros, Fagus sylvatica, Juglans, Morus, Prunus pissardi, Prunus* sp., *Quercus agrifolia, Quercus brandegeei, Quercus lobata, Quercus nigra, Quercus* sp., *Quercus undulata,* and *Vitis.*

Discussion:

This scale is comparatively uncommon in California. The species is apparently very closely related to *Diaspidiotus ehrhorni* (Coleman) but differs slightly in lacking dorsal macroducts in the outer angle (the fourth segment) of the pygidium, and usually possessing fewer perivulvar pores.

California records:

Lassen Co.: Hat Creek, 1940 (G. F. Ferris).

Los Angeles Co.: Beverly Hills, IV-22-38. Chatsworth, V-14-41. Glendale, VII-7-41; San Gabriel, V-7-41. San Marino, IX-9-48 (R. W. Harper and Griffen).

Orange Co.: Santa Ana, V-15-33 (E. A. Dudley and Balkam). Tustin, V-10-33 (L. E. Myers).

San Diego Co.: Blossom Valley, I-24-36 (R. R. McLean). San Diego, III-1929 (R. R. McLean). Sunnyside, III-30-35 (W. S. Binney).

Santa Clara Co.: Stanford University (G. F. Ferris).

Sonoma Co.: 1904 (Bremner).

Ventura Co.: Oxnard, III-30-33 (E. L. Smith).

Diaspidiotus uvae (Comstock)
Grape scale
(Fig. 30)

Aspidiotus uvae Comstock, 1881, Rep. U.S.D.A. for 1880, p. 309.

Aspidiotus uvaspis Lindinger, 1937, Ent. Jahrb., p. 180.

Diaspidiotus uvae (Comstock), Ferris, 1938, Atlas of Scale Insects, Ser. II:225.

Type locality: Vevay, Indiana.

Type host: *Vitis* sp., cultivated grape.

Relation to host: On the type host (grape) the scale occurs on the bark. Female scale whitish but sometimes changed into yellowish by a thin film of epidermis of the host species, circular, flat, exuviae central or subcentral; male scale

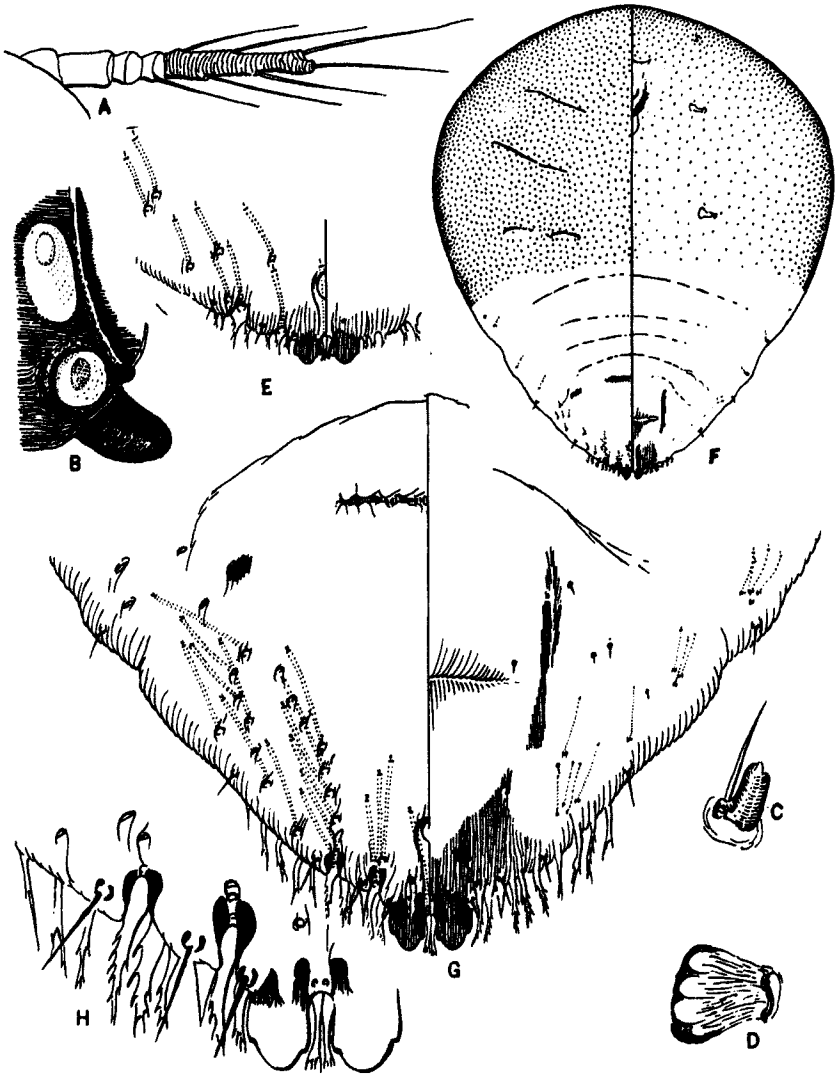

Fig. 28. *Diaspidiotus liquidambaris* (Kotinsky), sweet gum scale.

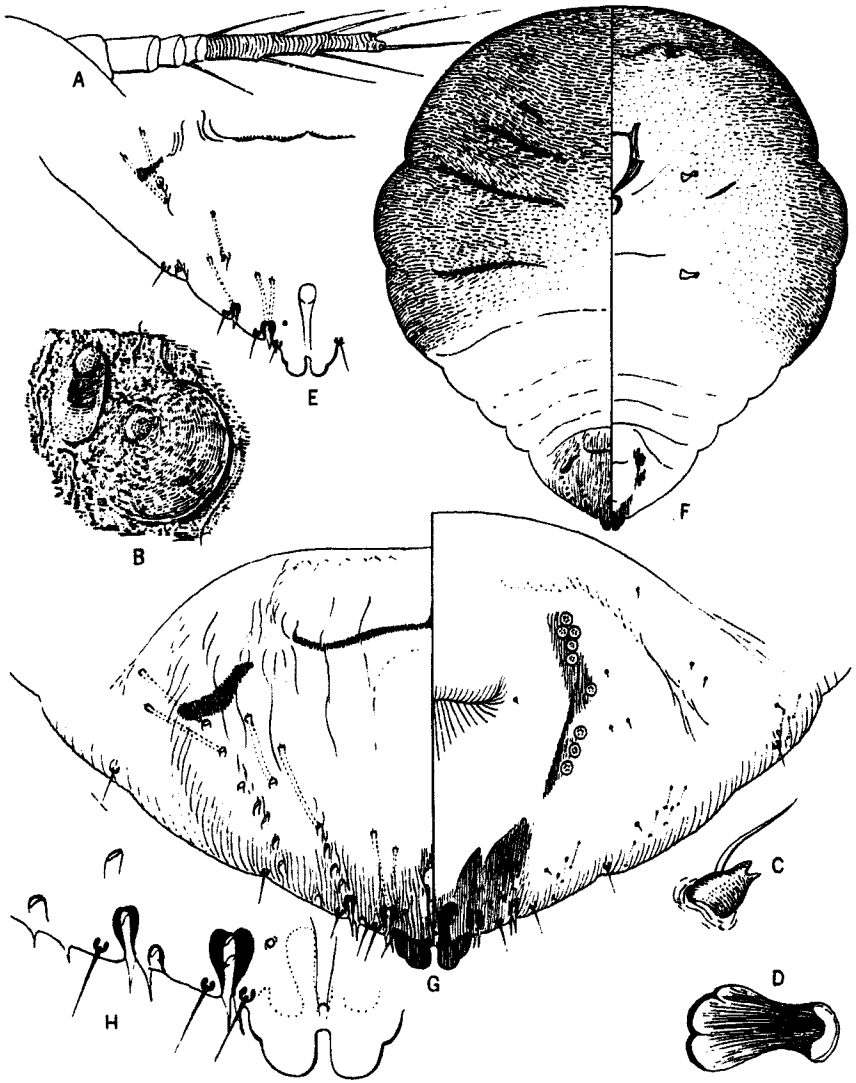

Fig. 29. *Diaspidiotus osborni* (Newell and Cockerell), Osborn scale.

usually darker than that of the female, elongate oval, exuvia near one end.

Additional hosts: *Betula, Carya, Crataegus, Maclura pomifera,* and *Platanus.*

Discussion:

This scale is extremely rare in California having been collected only once in San Diego County. The species is exceedingly close to *Diaspidiotus ancylus* (Putnam) and, according to Ferris (1938) "there is justification for skepticism as to the distinctness of the two. However, all the specimens at hand hold to the pattern which seems to be distinctive of the species and it seems to be so characteristically associated with grape that we may assume it to be a distinct genetic entity."

The adult female of *uvae* differs in form and color from that of *ancylus,* it being flat and whitish whereas that of the latter is convex and dark. Other differences include more prominent and more slender median pygidial lobes in *uvae* and there is no plate between them. The dorsal pygidial macroducts are noticeably more slender.

California records:

San Diego Co.: El Cajon, I-22-46 (C. Gammon and J. B. Steinweden).

Dynaspidiotus britannicus (Newstead)
Holly scale
(Fig. 31)

Aspidiotus britannicus Newstead, 1896, Ent. Mon. Mag., 34:93.

Evaspidiotus britannicus (Newstead), Leonardi, 1901, Riv. Patol. veg., 8:340.

Dynaspidiotus britannicus (Newstead), Ferris, 1938, Atlas of Scale Insects, Ser. II:229.

Type locality: England.

Type host: *Ilex* sp., holly.

Relation to host: Occurring on the leaves. Adult female scale gray or brown, circular, flat, with a subcentral exuviae; scale of the male gray, oval, exuvia near one end.

Additional hosts: *Berberis, Buxus sempervirens suffruticosa, Buxus* sp., *Hedera, Ilex aquifolium, Laurus nobilis, Rhamnus, Ruscus,* and *Viburnum.*

Discussion:

This species is commonly intercepted in Plant Quarantine on *Ilex aquifolium* (Holly) moving into California from Oregon and Washington. In California it is found principally in nurseries, although when discovered it is promptly eradicated. It represents the only species of the genus in North America. The pygidium of *britannicus* resembles *Aonidiella* but the membraneous prosoma precludes confusion with that group.

California records:

Alameda Co.: Berkeley, IV-18-45 (G. B. Laing). II-26-46 (M. R. Bell, J. Gallagher, J. L. Enos). Hayward, VI-6-49. Niles, XI-21-43 (M. R. Bell). Oakland IV-13-45 (M. R. Bell).

Colusa Co.: Colusa, XII-19-39 (M. Pryor).

Contra Costa Co.: Moraga, X-11-45 (M. R. Bell).

Humboldt Co.: Eureka, VI-15-44 (M. R. Bell).

Los Angeles Co.: Los Angeles, XII-20-28 (L. E. Myers). Pasadena, V-14-41.

Napa Co.: Napa, III-9-50 (J. H. Rodigou).

San Joaquin Co.: Lodi, X-9-50 (F. Hutchings).

San Mateo Co.: San Mateo, III-9-44 (M. R. Bell).

Santa Clara Co.: Gilroy, XII-21-53 (G. G. Bordenave).

Santa Cruz Co.: Watsonville, XII-17-49.

Sonoma Co.: Santa Rosa, V-6-47 (Michie, Choisser, S. M. Mather).

Sutter Co.: Live Oak, IV-10-50 (J. H. Rodigou).

Hemiberlesia cyanophylli (Signoret)
Cyanophyllum scale
(Fig. 32)

Aspidiotus cyanophylli Signoret, 1869, Ann. Soc. ent. Fr., 9(4):119.

Aspidiotus (Evaspidiotus) cyanophylli Signoret, Leonardi, 1899, Riv. Patol. veg., 7:53.

Furcaspis cyanophylli (Signoret), MacGillivray, 1921, The Coccidae, p. 407.

Hemiberlesia cyanophylli (Signoret), Ferris, 1938, Atlas of Scale Insects, Ser. II:237.

Type locality: France.

Type host: *Miconia magnifica* (=*Cyanophyllum magnificum*).

Relation to host: Occurring usually on the leaves of its host. Adult female scale whitish or gray, flat, elongate oval, exuviae central; male scale similar in form and color, exuvia near one end.

Additional hosts: *Annona, Anthericum, Anthurium, Cereus, Chrysalidocarpus lutescens, Cocos, Coffea, Eucalyptus, Eugenia, Ficus Inga, Kentia, Magnolia, Mangifera, Mondo, Pandanus, Pittosporum, Porlieria angustifolia, Rhododendron, Russelia, Smilax, Solanum,* and *Strelitzia reginae.*

Discussion:

This species is found predominately in nurseries, although several out-of-door infestations exist in southern California.

This species approaches most closely *Hemiberlesia howardii* (Cockerell) but is immediately separable from the latter by the well-separated

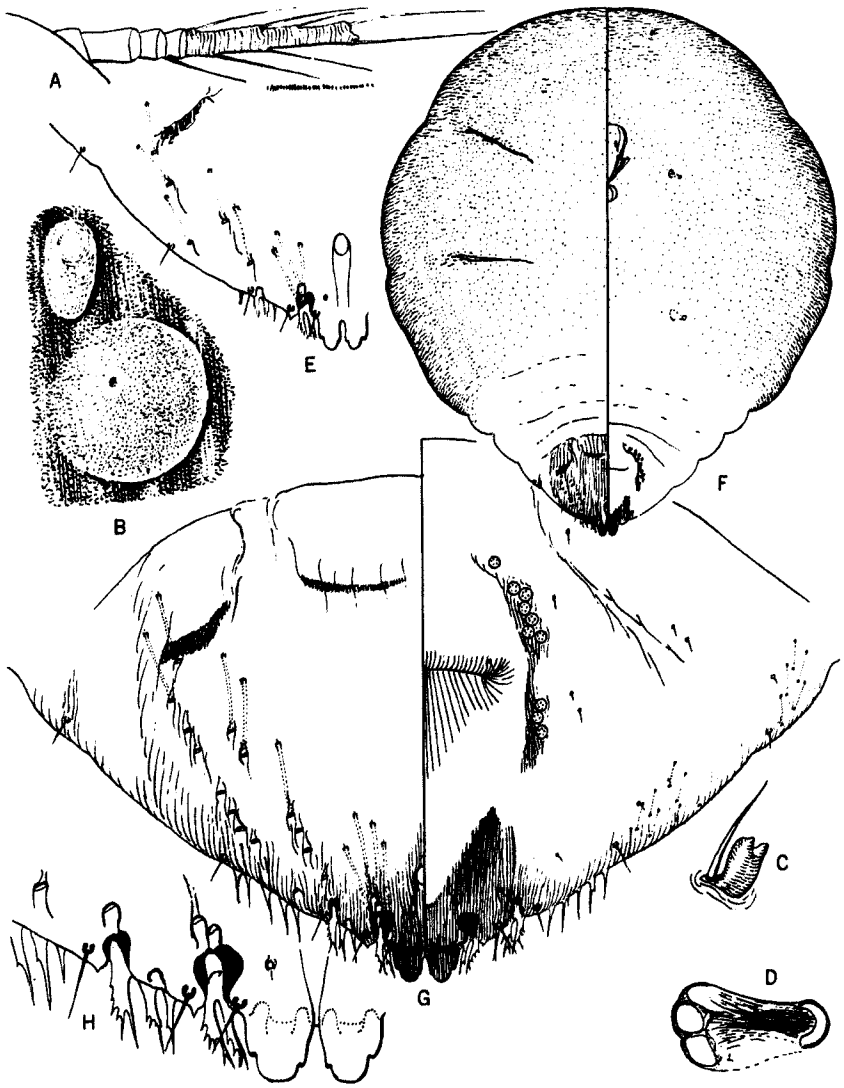

Fig. 30. *Diaspidiotus uvae* (Comstock), grape scale.

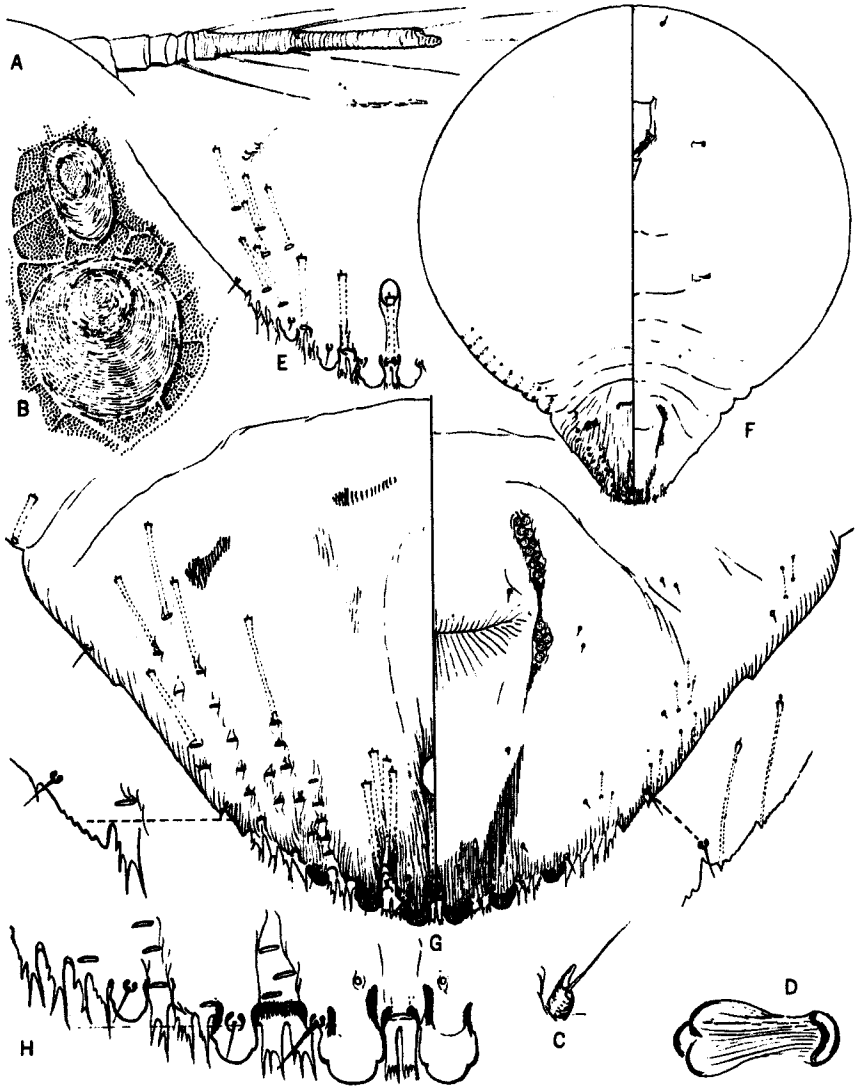

Fig. 31. *Dynaspidiotus britannicus* (Newstead), holly scale.

median lobes, the small acute, very definitely sclerotized third lobe, and the relatively large, but few dorsal pygidial macroducts. There is, characteristically, a row of four or five such ducts extending in from the second incision, this differing from *howardii* where the ducts are scattered in this position.

California records:

Los Angeles Co.: Alhambra, X-23-39. Beverly Hills, XI-29-39. Burbank, VI-5-41. Compton, V-11-37 (V. E. Williams). Hynes, I-14-41. Inglewood, VI-16-41. Lennox, XI-9-39. Lomita, VII-25-41. Long Beach, X-16-35 (V. E. Williams). Los Angeles, IX-7-33 (K. Smoyer). Montebello, IX-28-36 (V. E. Williams). North Hollywood, VI-13-36 (V. E. Williams). Pasadena, XI-10-41. Pomona, V-11-44 (L. E. Myers). Sawtelle, VIII-18-32 (A. Toyne); and Wilmar, II-13-40.

Placer Co.: Auburn, II-17-54 (M. D. Norman).

Sacramento Co.: Sacramento, IX-29-36 (W. B. Carter).

San Bernardino Co.: San Bernardino, VIII-7-41 (C. R. Tower).

San Diego Co.: San Diego, XI-25-42 (C. R. Tower and C. E. Ehmann).

San Francisco Co.: San Francisco, VIII-29-38 (F. J. March).

San Mateo Co.: Colma, X-28-31 (F. J. March).

Santa Barbara Co.: Santa Barbara, VII-27-43 (C. E. Ehmann and R. P. Allen).

Siskiyou Co.: Edgewood, V-4-50 (J. H. Rodigou).

Sonoma Co.: Forestville, XI-13-41 (M. R. Bell).

Ventura Co.: Ventura, IX-10-43 (R. A. Young).

Hemiberlesia degenerata (Leonardi)
Degenerate scale
(Pl. 1 middle row, center; fig. 33)

Chrysomphalus degeneratus Leonardi, 1896, Riv. Patol. veg., 4:345.

Aspidiotus (Chrysomphalus) degeneratus (Leonardi), Cockerell, 1897. U.S.D.A. Div. Ent. Bull. 6 Tech. Ser., p. 29.

Hemiberlesia degenerata (Leonardi), Ferris, 1941, Atlas of Scale Insects, Ser. III:342.

Type locality: Portici, Italy.

Type host: *Camellia japonica,* camellia.

Relation to host: Apparently restricted in its feeding habits to the leaves. Adult female scale yellowish or cream-colored, becoming white around the subcentrally situated exuviae, circular, slightly convex; scale of the male similar to female in color, broadly oval.

Additional hosts: *Aralia, Camellia* spp., *Citrus limon, Eurya japonica, Eurya ochnacea, Ilex comuta, Ilex integra* and *Osmanthus fragrans.*

Discussion:

This species is very common in California where its primary host is *Camellia.* It is predominately a nursery pest.

The species is most closely related to *Hemiberlesia howardi* (Cockerell), differing from it in the presence of macroducts on the dorsum of the prepygidial abdominal segments and in the character of the third pygidial lobe and the general arrangement of the pygidial macroducts.

California records:

Alameda Co.: Berkeley, VIII-25-41 (G. B. Laing). San Leandro, V-4-34 (F. J. March).

Butte Co.: Chico, IV-27-33 (E. T. Gammon). Oroville, VIII-1932 (B. B. Whitney).

Contra Costa Co.: Brentwood, X-17-41 (M. R. Bell).

Fresno Co.: Fresno, I-9-41 (J. W. Dixon). Kingsburg, XI-10-49 (A. Cox). Sanger, XI-1-39 (T. B. Gallion).

Kern Co.: Bakersfield, X-29-43 (C. S. Morley).

Los Angeles Co.: Alhambra, VIII-28-41. Altadena, IV-28-41. Arcadia, XI-10-28. Azusa, XI-21-39. Beverly Hills, XII-8-41. Burbank, XII-27-39. Covina, IV-2-36 (V. E. Williams). Downey, VIII-18-41. Encino, III-29-40. Glendale, X-10-36 (V. E. Williams). Inglewood, III-14-39. Long Beach X-16-35 (V. E. Williams). Los Nietos, X-28-38. Monrovia, IV-16-36 (V. E. Williams). Montebello, III-8-40 (C. R. Tower). Monterey Park, X-10-38. North Hollywood, XII-11-39. Pacoima, XII-15-40. Pasadena, I-12-33 (L. E. Myers). Pomona, VI-21-41. San Gabriel, VIII-4-36 (V. E. Williams). San Pedro, IV-5-39. Sierra Madre, IX-12-41. Temple City, XI-17-39. Van Nuys, VI-3-36 (V. E. Williams).

Merced Co.: Los Banos, VI-8-42 (E. C. McDaniel). Merced, III-22-40 (C. H. Kinsley).

Napa Co.: Napa, II-3-41 (W. D. Butler).

Orange Co.: Anaheim, IX-7-43 (Wymore). Corona del Mar, VI-26-41 (C. R. Tower). Fullerton, III-29-44 (R. J. Bumgardner). Santa Ana, VI-1941 (C. R. Tower).

Placer Co.: Auburn, XII-1931 (C. K. Turner).

Riverside Co.: Riverside, III-23-50 (Barcon).

Sacramento Co.: Roseville, II-19-32 (J. E. Bachman). Sacramento, II-27-33 (M. L. Jones).

San Bernardino Co.: Ontario, VII-11-41 (C. R. Tower). Redlands, I-27-47. San Bernardino, VIII-14-41 (C. R. Tower). Upland, VII-16-41 (C. R. Tower).

San Diego Co.: San Diego, I-29-40 (R. R. McLean).

San Joaquin Co.: Lodi, V-12-34 (F. J. March). Stockton, IV-1-46 (J. Solari).

Santa Barbara Co.: Santa Barbara, I-13-43 (J. B. Steinweden).

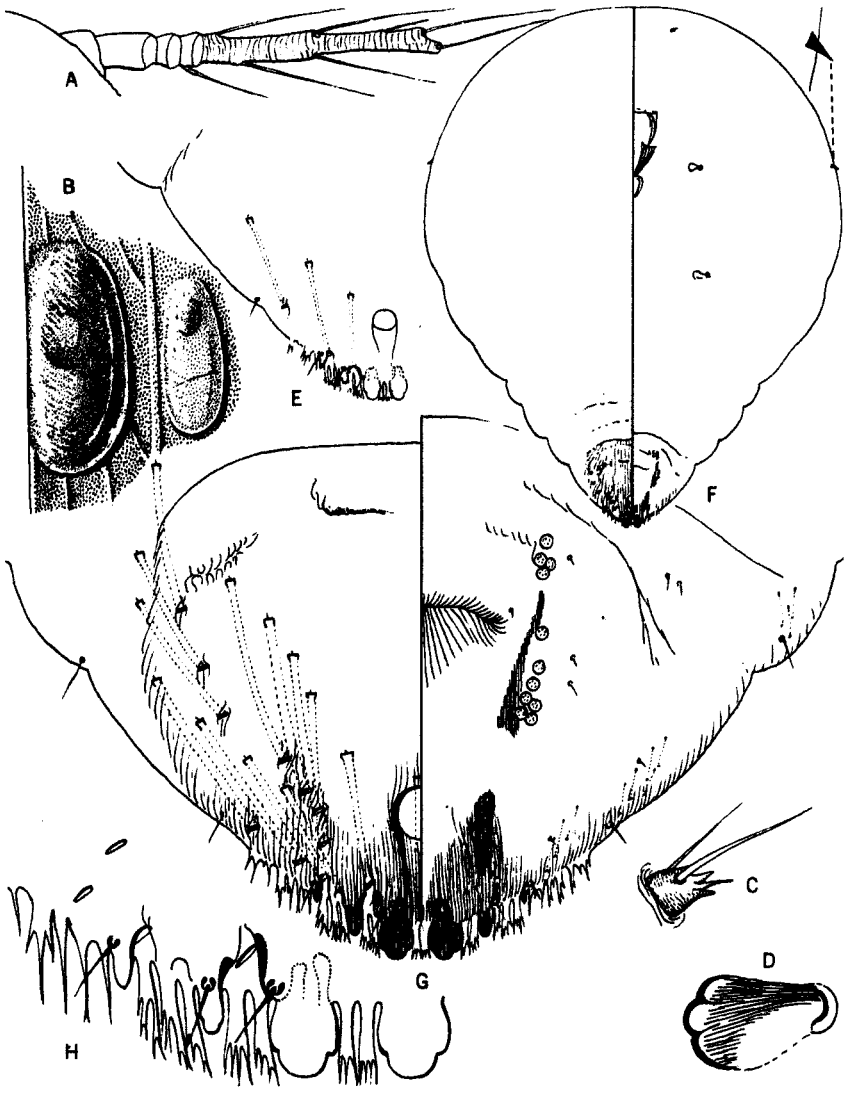

Fig. 32. *Hemiberlesia cyanophylli* (Signoret), Cyanophyllum scale.

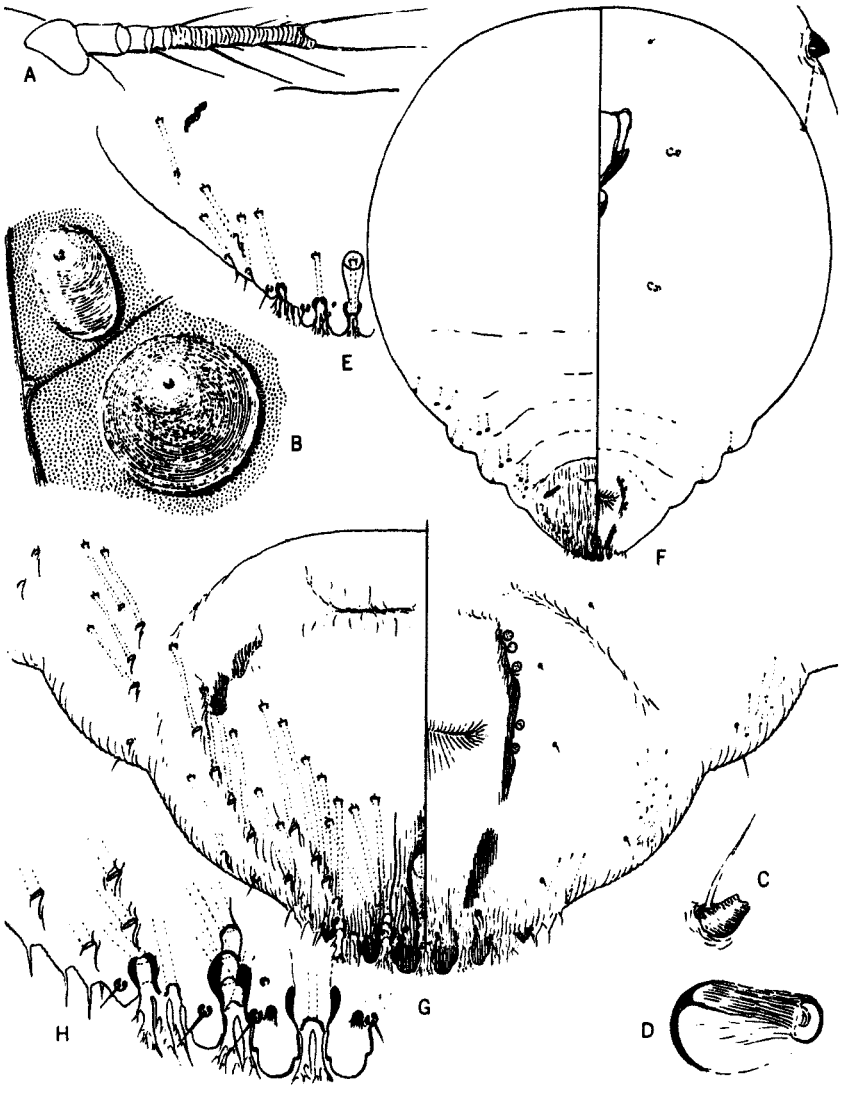

Fig. 33. *Hemiberlesia degenerata* (Leonardi), degenerate scale.

Santa Clara Co.: San Jose, V-2-34 (F. J. March).
Santa Cruz Co.: Santa Cruz, VII-27-42 (M. R. Bell).
Sonoma Co.: Sebastopol, XI-12-41 (M. R. Bell).
Stanislaus Co.: Modesto, I-23-40 (J. B. Steinweden).
Tehama Co.: Red Bluff, VIII-1932 (B. B. Whitney).
Tulare Co.: Dinuba, XI-2-39 (F. G. Lackland). Lemon Cove, VII-19-46 (F. G. Lackland). Visalia, III-24-39 (O. L. Hemphill).
Ventura Co.: Camarillo, VI-10-40 (J. S. Schall). Santa Paula, III-24-43 (J. S. Schall). Saticoy, III-17-38 (E. L. Smith). Ventura, VII-20-38 (R. A. Young).
Yolo Co.: Clarksburg, XI-22-43 (Morgan).

Hemiberlesia fraxini McKenzie
Ash scale
(Fig. 34)

Hemiberlesia fraxini McKenzie, 1944, Calif. Dept. Agric. Bull. 33:1, pp. 53-54, illus.
Type locality: Indio (near La Quinta), Riverside County, California.
Type host: *Fraxinus velutina,* Arizona ash.
Relation to host: Occurring on the leaves of ash and causing noticeable injury by removing chlorophyll from the leaf tissue. Adult female scale yellowish, flat, almost circular, exuviae subcentrally placed, male scale similar in color to that of the female, elongate oval, exuvia toward one end.
Additional hosts: *Fraxina velutina* is the only recorded host on which this scale has been taken.
Discussion:
This scale is closely related to *Hemiberlesia colorata* (Cockerell) (this species not present in California), but differs in the total absence of supernumerary perivulvar pores and in the arrangement of dorsal macroducts on the pygidium. *Hemiberlesia degenerata* (Leonardi) probably approaches *fraxini* taxonomically more than any other California species of this genus.
California records:
Riverside Co.: Indio (near La Quinta), XII-17-43 (F. R. Platt). This is type collection.

Hemiberlesia howardi (Cockerell)
Howard scale
(Fig. 35)

Aspidiotus howardi Cockerell, 1895, Canad. Ent., 27:16.
Aspidiotus townsendi Cockerell, 1896, Psyche, 7(1):20.
Aspidiotus pseudospinosus Woglum, 1906, Canad. Ent., 38:75, illus.
Aspidiotus epigaeae Marlatt, 1908, U.S.D.A., Bur. Ent., Tech. Ser. 16:2, pp. 21-22, illus.
Hemiberlesia howardi (Cockerell), Ferris, 1938, Atlas of Scale Insects, Ser. II:240.
Type locality: Canyon City, Colorado.
Type host: *Prunus* sp., fruit of cultivated plum.
Relation to host: Characteristically occurring on the leaves of the host, occasionally on the fruit. Adult female scale whitish, flat, and rather thin, usually circular although at times modified by its habit of settling against a leaf vein, exuviae subcentral; male scale similar to that of the female in color, elongate oval, exuvia subcentral.
Additional hosts: Presumably recorded from a long series of host plants although many of these records are doubtful because of misidentifications. Ferris (1938) records the following hosts for this scale: *Epigaea repens, Fraxinus, Maclura pomifera, Magnolia, Malus pumila, Prunus persica, Prunus* spp., and *Sabal.* In addition to the hosts listed by Ferris, California State Department of Agriculture collections indicate the species occurrence on *Ilex cornuta, Ilex opaca, Maranta, Prunus armeniaca, Pyracantha,* and *Viburnum.*
Discussion:
Of the California *Hemiberlesia* this species appears more closely related to *Hemiberlesia cyanophylli* (Signoret), differing chiefly in the absence of a sclerotized third lobe.
California records:
Orange Co.: Santa Ana, XII-10-46 (P. E. Martin).
Riverside Co.: Hemet, XII-7-44 (O. H. Eggen). San Jacinto, IX-16-47 (R. W. Harper).

Hemiberlesia lataniae (Signoret)
Latania scale
(Pl. 1, middle row, right; fig. 36)

Aspidiotus lataniae Signoret, 1869, Ann. Soc. ent. Fr., 4(9):124.
Aspidiotus cydoniae Comstock, 1881, Rep. U.S. D.A. for 1880, p. 295.
Aspidiotus punicae Cockerell, 1893, Jour. Inst. Jamaica, 1:225.
Aspidiotus cydoniae variety *tectus* Maskell, 1897, Ent. Mon. Mag., 33:240.
Aspidiotus implicatus Maskell, 1897, Ent. Mon. Mag., 33:241.
Aspidiotus diffinis variety *lateralis* Cockerell,

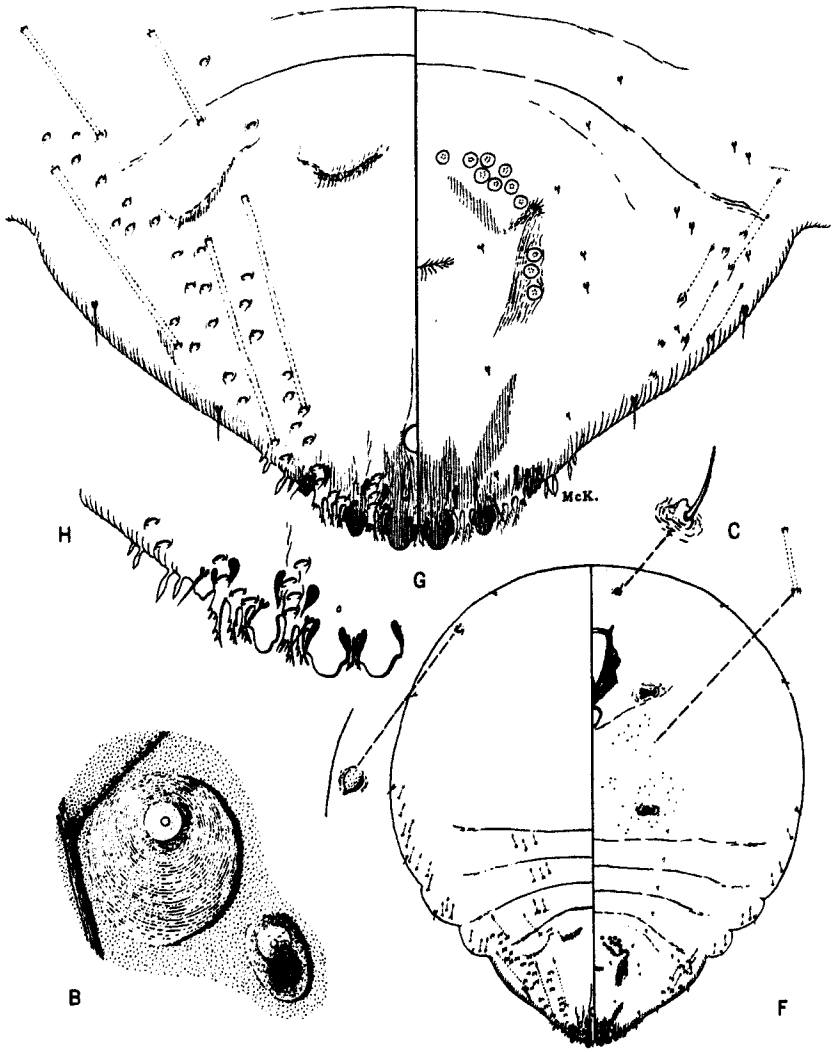

Fig. 34. *Hemiberlesia fraxini* McKenzie, ash scale.

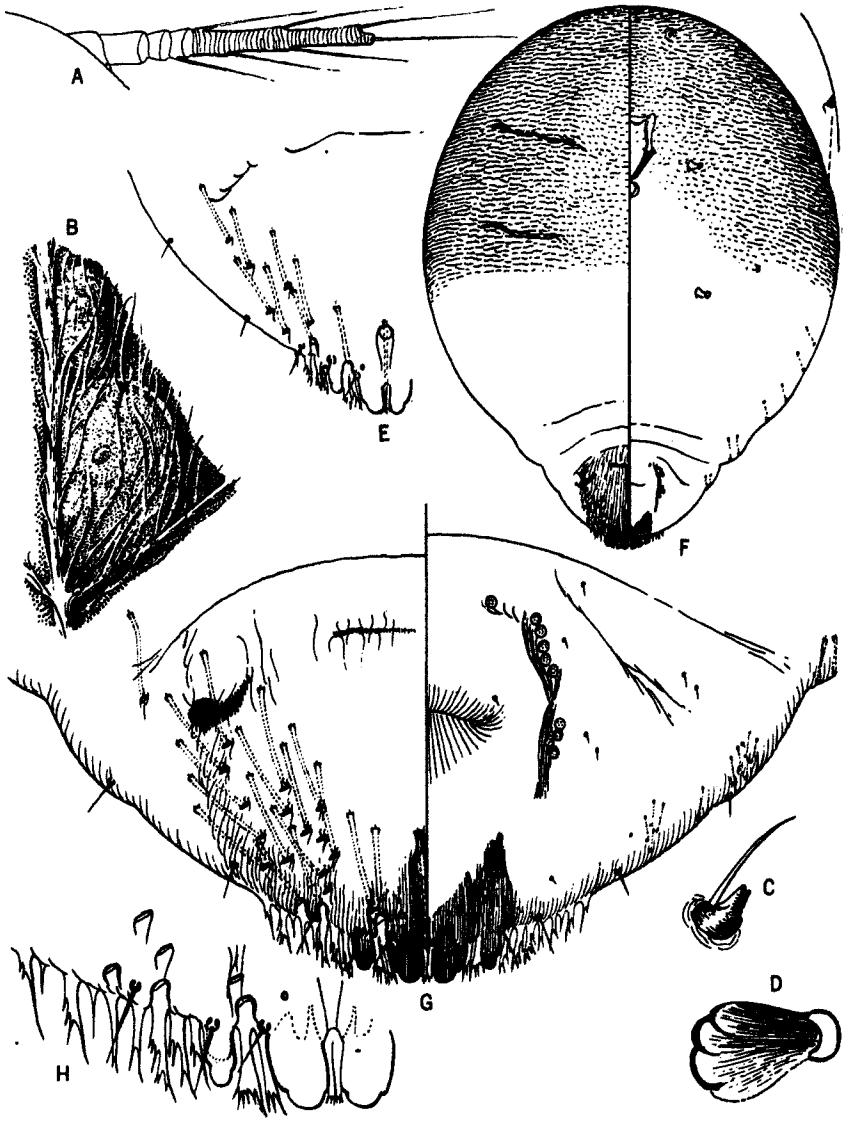

Fig. 35. *Hemiberlesia howardi* (Cockerell), Howard scale.

1897, Div. Ent., Bull. 6, Tech. Ser., U.S.D.A. p. 23.

Aspidiotus (Hemiberlesia) crawii Cockerell, 1897, Div. Ent., Bull. 6, Tech. Ser., U.S.D.A., pp. 5 and 23.

Aspidiotus greenii Cockerell, 1898, Ent. Mon. Mag., 34:184.

Hemiberlesia lataniae (Signoret), Ferris, 1938, Atlas of Scale Insects, Ser. II:241.

Type locality: Presumably France.

Type host: Latania palm.

Relation to host: The species occurs on any part of the host, although perhaps most commonly on the bark. Scale of the female grayish or white, the exuviae darker, quite convex with exuviae toward one side, the scale thus having a slightly tilted appearance; male scale unknown.

Additional hosts: This scale is exceedingly omnivorous in its feeding habits and has been recorded from an endless series of hosts in all tropical and subtropical parts of the world. A few of the California hosts include: *Acacia, Cedrus, Euonymus, Fatsia, Fuchsia, Gladiolus* (corms in ground) *Grevillea, Hedera helix, Kentia, Olea europeae, Persea, Philodendron, Rosa, Rubus, Salix,* and *Yucca.*

Discussion:

This scale is very common in California on a wide range of hosts including almost all woody plants, except perhaps oaks and some conifers. It is very closely allied to *Hemiberlesia rapax* (Comstock) but differs from it mainly in the possession of perivulvar pores, more slender conformation and membranous second and third pygidial lobes and a slightly smaller anal opening removed by a greater distance from the median lobes.

California records: Listed below are a few of the locality records accumulated in the collection of the California State Department of Agriculture:

Alameda Co.: Berkeley, IX-15-41 (M. R. Bell). Oakland, V-21-40 (F. J. March).

Fresno Co.: Fresno, III-10-39 (J. W. Dixon). Parlier, V-14-40 (T. B. Gallion). Reedley, XII-12-39 (T. B. Gallion).

Kern Co.: Bakersfield, X-9-46 (J. W. Dixon). Delano, 1947.

Los Angeles Co.: Downey, XI-5-36 (V. E. Williams). Brentwood, X-30-? (V. E. Williams). Gardena, III-23-42 (F. R. Platt). West Los Angeles, V-24-44. Los Angeles, IV-11-38 (V. E. Williams). Montebello, I-9-34 (C. R. Tower). Pomona, VII-9-41 (C. R. Tower). Whittier, XI-12-31.

Marin Co.: Mill Valley, I-6-44 (M. R. Bell). San Rafael, XII-29-43 (M. R. Bell).

Mendocino Co.: Ukiah, X-29-41 (M. R. Bell).

Merced Co.: Gustine, VI-24-42 (W. A. McDaniel). La Braza, XI-1-43 (E. A. Danison). Merced, I-22-40 (J. W. Dixon).

Napa Co.: Napa, VI-27-32 (A. C. Browne).

Orange Co.: Capistrano, III-16-34 (D. W. Tubbs). Corona del Mar, VI-25-41 (C. R. Tower). Costa Mesa, II-23-41. Santa Ana, X-20-41 (D. D. Sharp). Tustin, VII-24-30 (P. S. Barth).

Riverside Co.: Elsinore, I-21-43 (F. R. Platt); Riverside, XII-10-47.

Sacramento Co.: Sacramento, IX-29-36 (W. B. Carter).

San Bernardino Co.: Ontario, II-8-32 (G. A. Pohl).

San Diego Co.: Carlsbad, III-18-34 (D. F. Palmer). Chula Vista IX-15-38 (W. Binney). Encinitas, V-1-34 (H. L. McKenzie). San Diego, XI-2-39 (C. R. Tower).

San Francisco Co.: San Francisco, V-4-38 (J. B. Steinweden).

San Joaquin Co.: Escalon, II-6-32 (Huerlin). Stockton, III-1-44 (J. B. Steinweden). Tracy, XII-21-38 (J. W. Dixon).

San Mateo Co.: Colma, X-21-31 (F. J. March). Millbrae, X-21-31 (F. J. March).

Santa Barbara Co.: Carpenteria, III-26-35 (G. E. Woodhams). Goleta, X-16-36 (W. S. Cummings). Santa Barbara, X-28-43 (J. B. Steinweden).

Sonoma Co.: Santa Rosa, XI-5-41 (M. R. Bell).

Tulare Co.: Dinuba, XI-28-39 (F. L. Lackland). Visalia, IV-11-36 (O. L. Hemphill).

Ventura Co.: Camarillo, XII-10-37 (L. T. Stratton). Oxnard, I-8-36 (L. T. Stratton). Santa Paula, III-29-34 (E. L. Smith). Ventura, I-21-36 (E. L. Smith).

Yuba Co.: Marysville, IX-9-42 (H. A. Crane).

Hemiberlesia palmae (Cockerell)
Tropical palm scale
(Fig. 37)

Aspidiotus palmae Cockerell, 1893, Ent. Mon. Mag., 39:39-40.

Aspidiotus palmae Morgan, 1893, Ent. Mon. Mag., 39:40.

Furcaspis palmae (Morgan), MacGillivray, 1921, The Coccidae, p. 407.

Hemiberlesia palmae (Cockerell), Ferris, 1938, Atlas of Scale Insects, Ser. II:242.

Type locality: Jamaica.

Type host: *Cocos nucifera* (coconut palm).

Relation to host: Occurring on the leaves. Adult female scale oval, quite convex, white, exuviae subcentral and dark; male scale not observed.

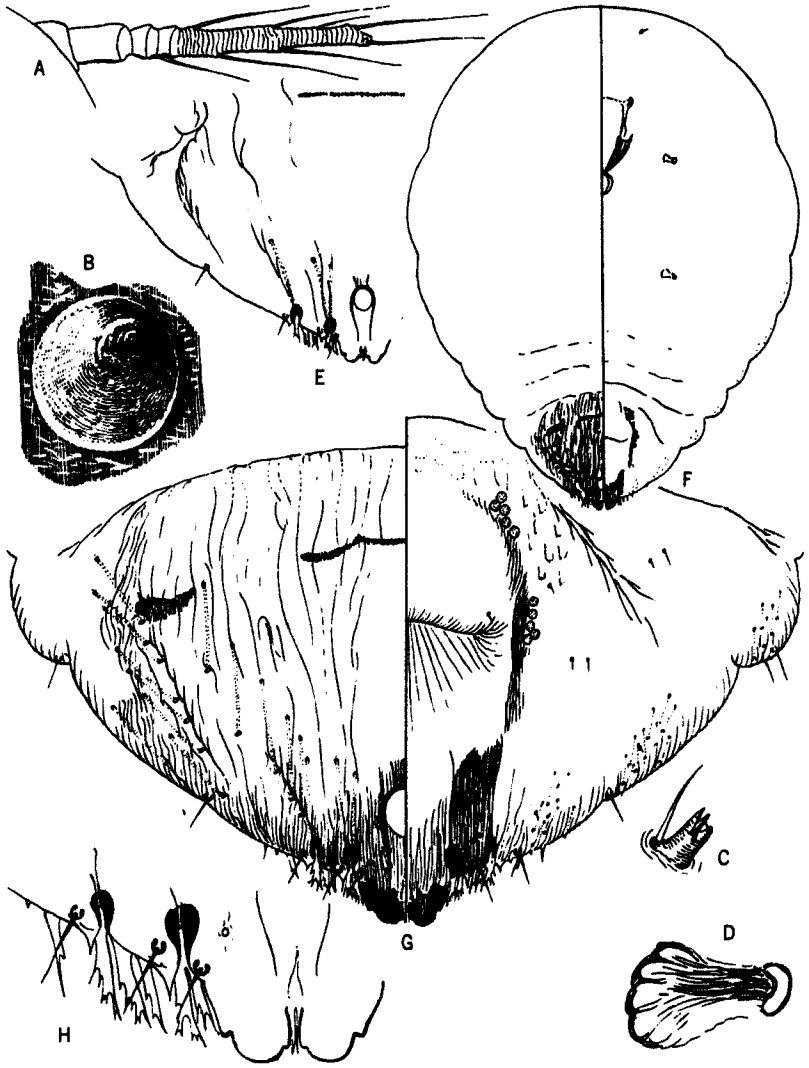

Fig. 36. *Hemberlesia lataniae* (Signoret), latania scale.

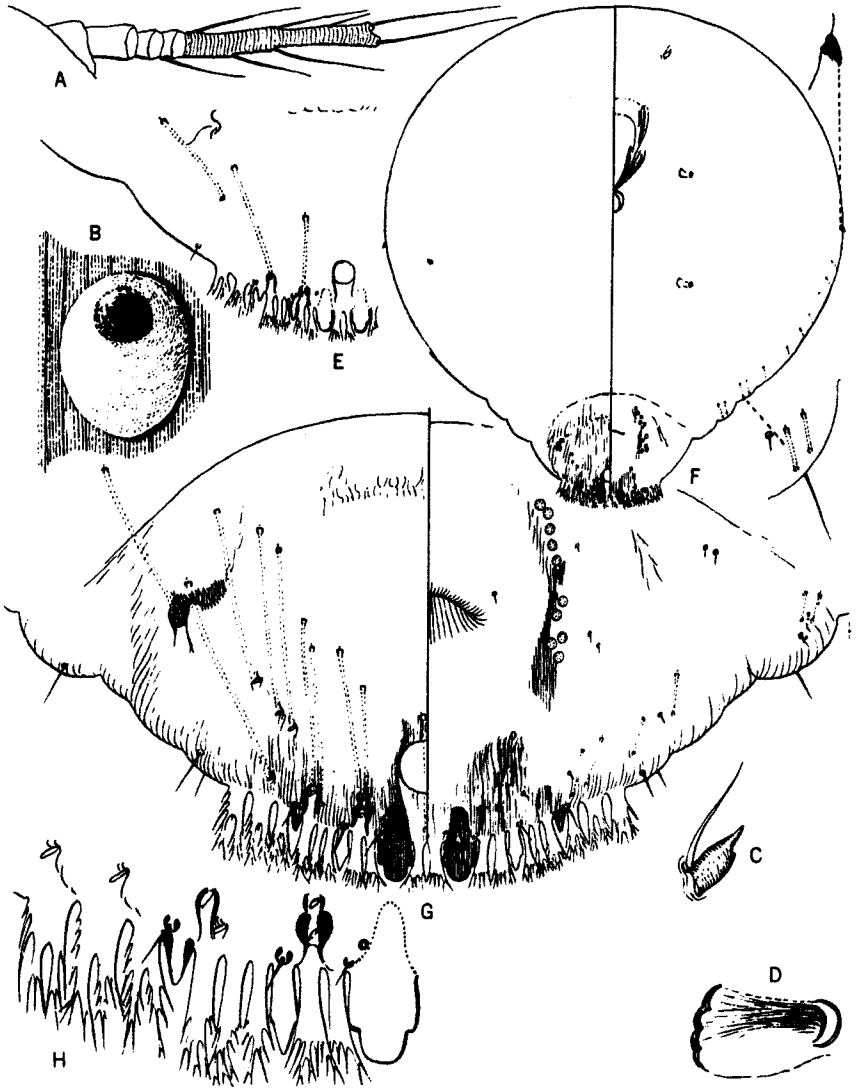

Fig. 37. *Hemiberlesia palmae* (Cockerell), tropical palm scale.

Additional hosts: *Aechmea weilbachia, Billbergia,* Bromeliads, *Ficus,* and *Musa paradisiaca sapientum.*

Discussion:

This species is similar to *Hemiberlesia cyanophylli* (Signoret) but differs from it principally in the extraordinary development of the pygidial plates which are all larger and longer than the median and other lobes. Other key characters include an unsclerotized second pygidial lobe, and a strongly sclerotic, toothlike, third lobe.

Hemiberlesia palmae (Cockerell) was found established in a California nursery in 1942. Since that time it has been eradicated whenever discovered. The species has not been collected for several years, thus indicating the possibility of its being eradicated from the state.

California records:

Los Angeles Co.: Brentwood, X-30-? (V. E. Williams). Gardena, III-23-42 (F. R. Platt). West Los Angeles, V-24-44.

Hemiberlesia popularum (Marlatt)
Poplar scale
(Fig. 38)

Aspidiotus (Hemiberlesia) popularum Marlatt, 1908, Bur. Ent., Bull. Tech. Ser., U.S.D.A., 16:2-23, illus.

Diaspidiotus popularum (Marlatt), MacGillivray, 1921, The Coccidae, p. 414.

Hemiberlesia popularum (Marlatt), Ferris, 1938, Atlas of Scale Insects, Ser. II:243.

Type locality: Deming, New Mexico.

Type host: *Populus* sp., cottonwood.

Relation to host: Occurring on the bark of its host. Scale of the female yellowish-white, oval, high convex, the submarginal exuviae darker; male scale white, elongate oval, exuviae toward one end.

Additional hosts: *Baccharis viminea, Fraxinus* sp., *Pluchea sericea, Salis, Ulmus pumila,* and *Viscum album.*

Discussion:

The large anal opening and the lack of development of the second and third pairs of pygidial lobes relate this species rather closely to *Hemiberlesia lataniae* (Signoret). However, the greatly reduced plates and the more numerous dorsal pygidial macroducts readily separate it for that species.

California records:

Los Angeles Co.: Antelope Valley, II-11-55 (G. Brown and L. E. Myers). Lancaster, XII-16-42 (W. E. Shilling). Orange Co.: Brea, III-19-53 (W. M. Amling). Ventura Co.: Piru, V-21-43 (C. R. Tower).

Hemiberlesia quercicola Ferris
Irregular oak scale
(Fig. 39)

Hemiberlesia quercicola Ferris, 1941, Atlas of Scale Insects, Ser. II:344.

Type locality: Banner, San Diego County, California.

Type host: *Quercus engelmanni,* Engelmann oak.

Relation to host: Occurring in bark cracks and under bark flakes. Adult female scale irregular in shape because of its habitat, although believed to be almost circular and with subcentral exuviae, yellowish and normally covered with secretion. Scale of male not observed.

Additional hosts: *Quercus* spp.

Discussion:

According to Ferris (1941) the "generic position of this species is extremely doubtful." Actually the species more closely resembles *Aonidia shastae* (Coleman) though in *H. quercicola* the adult female is not partly enclosed in the second exuvia. Ferris states the assignment of this species to *Hemiberlesia* is geographically sound, and it seems probable that the species is actually a member of that generic stock.

California records:

San Diego Co.: Banner, 1939 (G. F. Ferris). Palomar Mt. State Park, XI-27-54 (R. F. Wilkey).

Hemiberlesia rapax (Comstock)
Greedy scale
(Fig. 40)

Aspidiotus rapax Comstock, 1881, Rep. U.S.D.A. for 1880, p. 307, illus.

Aspidiotus convexus Comstock (in part), 1894, Canad. Ent., 26:287.

Aspidiotus tricolor Cockerell, 1897, Canad. Ent., 29:266.

Aspidiotus lucumae Cockerell, 1899, Biol. centamer., 2:2, p. 22.

Aspidiotus camelliae Signoret, various authors (see remarks by Ferris below).

Hemiberlesia rapax (Comstock), Ferris, 1938, Atlas of Scale Insects, Ser. II:244.

Ferris (1938) has made the following remarks relative to synonymy of *Aspidiotus camelliae* Signoret. "It has been maintained by various authors that this species is that which was recorded by Signoret as *Aspidiotus camelliae*

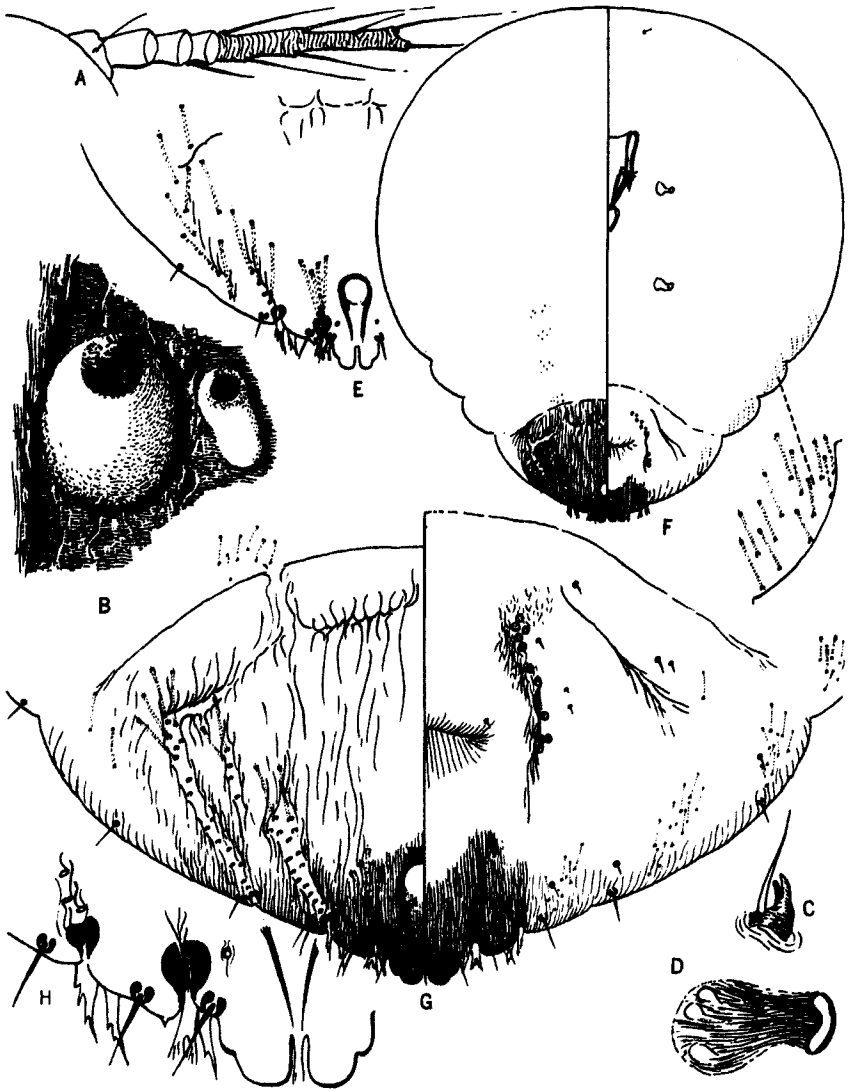

Fig. 38. *Hemiberlesia popularum* (Marlatt), poplar scale.

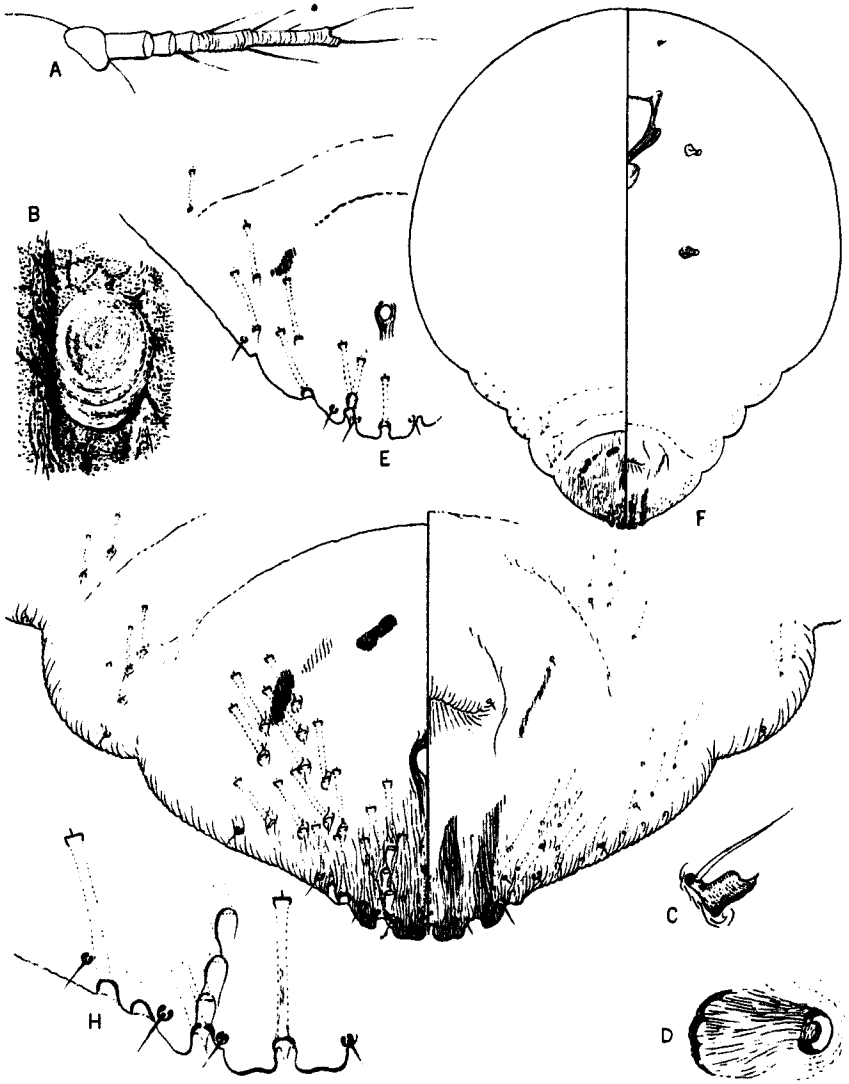

Fig. 39. *Hemiberlesia quercicola* Ferris, irregular oak scale.

Boisduval and this name has even been attributed to Signoret as author, although he specifically ascribed it to Boisduval and was evidently not proposing the name as new. Unless an examination of Signoret's specimens should show that he was actually dealing with this species the author is not prepared to displace the name *rapax,* the application of which is definite, in favor of any doubtful identification of Signoret's specimens, or any even more doubtful identification of Boisduval's species."

Type locality: California and Florida.

Type host: Various trees and shrubs.

Relation to host: Occurring on the leaves and bark. Adult female scale gray, markedly convex, the darker exuviae near one end, the scale thus having a strongly tipped-over appearance. Male scale unknown.

Additional hosts: This scale is recorded from innumerable hosts in all parts of the United States, except possibly the extreme northern part. There is a possibility that it may be found upon almost any woody plant.

Discussion:

Hemiberlesia rapax is readily identifiable by the relatively huge anal opening situated near the median pygidial lobes, the absence of perivulvar pores, the weakly indicated second and third pygidial lobes and the few, very small, delicate dorsal pygidial macroducts. It is very closely related to *Hemiberlesia lataniae* (Signoret), its "twin" species, but the absence of the perivulvar pores in *rapax* affords an easy separation.

California records: Only a few specific localities are listed for this species since it is so very generally distributed throughout the State.

Alameda Co.: Berkeley, V-3-38 (L. E. Myers). Niles, XI-2-49.

Kern Co.: Taft, III-27-50 (J. Stockton).

Los Angeles Co.: Altadena, IV-18-35 (L. E. Myers). Van Nuys, III-9-33 (L. E. Myers).

Monterey Co.: Aromas, VIII-12-31 (A. C. Browne).

Orange Co.: Orange, X-5-38 (T. B. Gallion). Santa Ana, VIII-25-36 (C. E. Norland).

Placer Co.: Auburn, III-18-35 (F. Clark).

Riverside Co.: Beaumont, XI-3-50 (L. Cordill).

Sacramento Co.: Sacramento, III-1-33 (W. B. Carter).

San Bernardino Co.: San Bernardino, IV-8-48.

San Diego Co.: El Cajon, XI-5-34. Palm City, VII-8-30 (L. S. Jones).

San Francisco Co.: San Francisco, X-10-28 (F. J. March).

San Joaquin Co.: Stockton, III-5-52 (W. Bottel).

San Luis Obispo Co.: San Luis Obispo, XI-1937 (Fetters).

San Mateo Co.: San Mateo, XII-21-36 (I. J. Campbell).

Santa Cruz Co.: Watsonville, I-18-52 (L. C. Huston).

Ventura Co.: Camarillo, VI-10-38 (R. A. Young). Ventura, V-4-37 (F. L. Smith).

Lindingaspis rossi (Maskell)
Black araucaria scale
(Pl. 1, bottom row, center; fig. 41)

Aspidiotus rossi Maskell (for 1890), Trans. N.Z. Inst., 23:3.

Chrysomphalus rossi (Maskell), Kuwana, 1933, Minist. Agric. Forest. Japan, Sci. Bull., 3:32, illus.

Lindingaspis rossi (Maskell). Ferris, 1938, Atlas of Scale Insects, Ser. II:246.

Lindingaspis rossi (Maskell), McKenzie, 1950, Microentomology, 15(3): 98-124, illus.

The identification of this species is somewhat beclouded. It rests upon identification of Australian material apparently made by Froggatt and upon material from the vicinity of Sydney, Australia, which agrees with this.

Type locality: Adelaide, Melbourne, and Sydney, Australia.

Type host: Originally reported as on "almost every kind of plant."

Relation to host: Occurring on the leaves of the host. Scale of the female quite flat, circular, very dark brown or black, exuvia black and almost centrally located; scale of the male slightly elongate oval, dark brown, with exuvium near one end. There is a rather thick ventral scale formed by the adult female.

Additional hosts: *Abutilon, Artemisia, Araucaria* spp., *Camellia, Citrus, Coccolobis, Eucalyptus, Euonymus, Ficus* (fig and rubber tree), *Gardenia, Hedera helix, Hyssop, Nerium oleander, Olea europaea,* palm, *Ricinocarpos, Sequoia* (redwood), and *Xanthorrhea.*

Discussion:

As far as is known this is the only species of *Lindingaspis* in California. It is rather closely related to *Lindingaspis floridana* Ferris (known in the United States from West Palm Beach, Florida), but differs in possessing a submarginal, lateral series of dorsal medium-sized pygidial macroducts originating at or near the lateral scar and extending posteriorly.

California records:

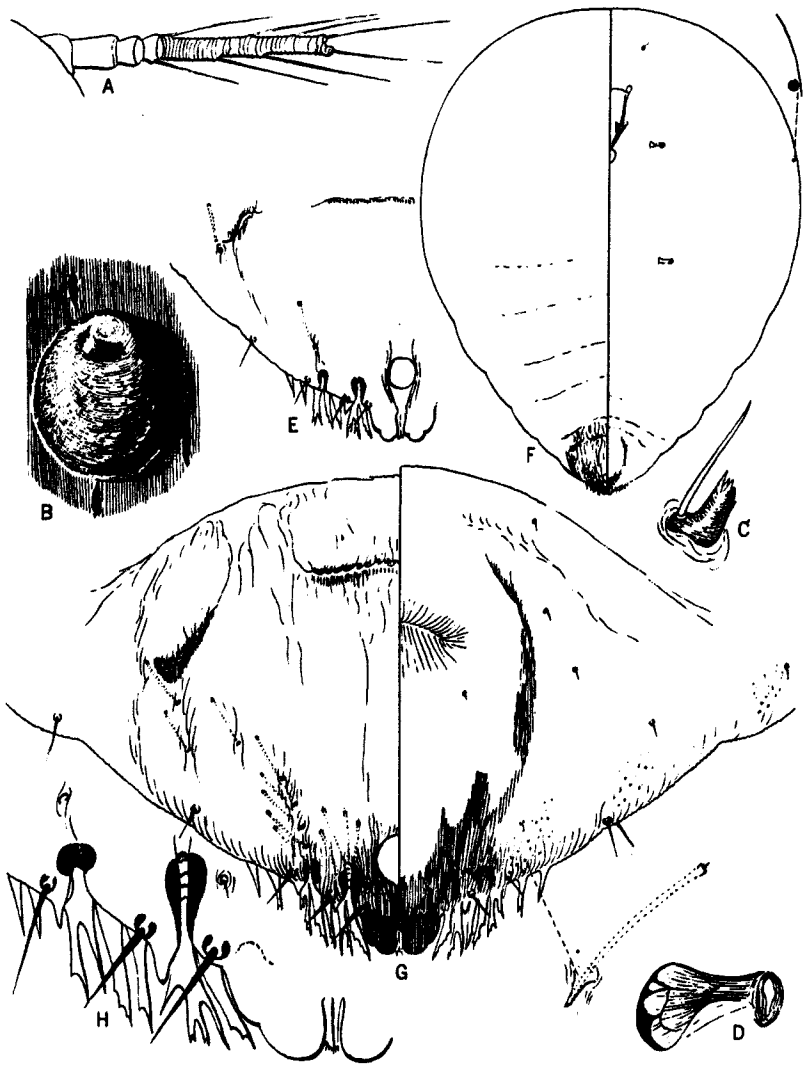

Fig. 40. *Hemiberlesia rapax* (Comstock), greedy scale.

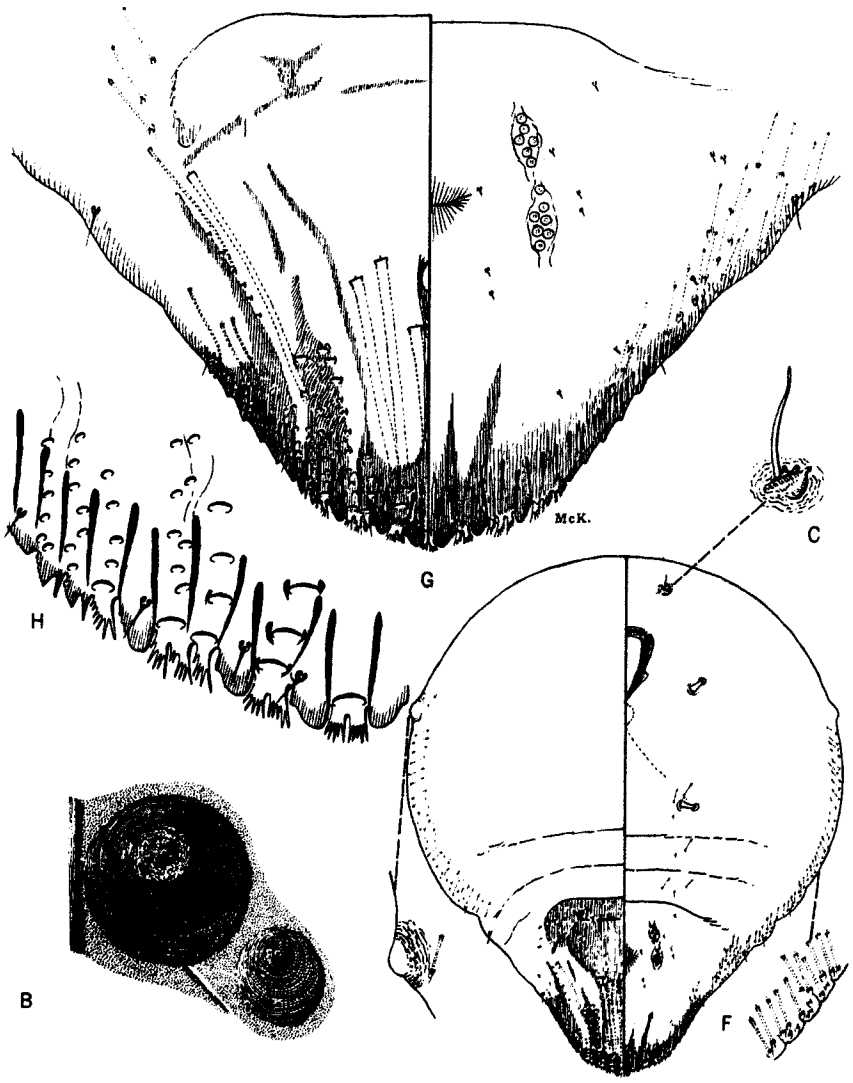

Fig. 41. *Lindingaspis rossi* (Maskell), black araucaria scale.

Los Angeles Co.: Alhambra, X-16-36 (V. E. Williams). Los Angeles, VIII-14-42, (C. R. Tower). Pasadena, V-11-31 (L. S. Jones). Sierra Madre, XI-27-36 (V. E. Williams).

Orange Co.: Fullerton, 1944 (L. R. Gillogly). Garden Grove, VII-24-43 (Andres). Yorba Linda, II-20-47 (Newson and Bruington).

San Diego Co.: Chula Vista, VII-27-44 (C. E. Ehmann). San Diego, VIII-20-43 (D. F. Palmer).

San Luis Obispo Co.: San Luis Obispo, VI-19-42 (M. R. Bell).

Santa Barbara Co.: Montecito, XI-29-43 (R. P. Allen). Santa Barbara, XII-22-47 (R. W. Harper and R. P. Allen).

Ventura Co.: Santa Paula, V-23-48 (R. A. Young). Santa Susana, I-28-32 (W. M. Dunning). Simi, VII-5-32 (L. Onstot). Ventura, VII-1931 (C. R. Tower).

Melanaspis lilacina (Cockerell)
Dark oak scale
(Fig. 41*a*)

Aspidiotus lilacinus Cockerell, 1898, Ann. Mag. Nat. Hist., 7(2):26.

Chrysomphalus lilacinus Cockerell, 1899, Biol. cent-amer., 2(2):27.

Pelomphala lilacina (Cockerell), MacGillivray, 1921, The Coccidae, p. 442.

Melanaspis lilacina (Cockerell), Ferris, 1941, Atlas of Scale Insects, Ser. III:357.

Type locality: Dripping Spring, Organ Mountains, New Mexico..

Type host: *Quercus* sp., oak.

Relation to host: A bark-infesting species, usually not much concealed. Adult female scale dark gray, circular, flattened, exuviae subcentral and blackish; male scale smaller than the female and elongate, exuvia at one end.

Additional hosts: Recorded only from various species of *Quercus*. Ferris' records include *Quercus agrifolia, Q. engelmanni, Q. texana, Q. undulata,* and *Quercus* spp.

Discussion:

This species is readily distinguished from *Melanaspis obscura* (Comstock) by the absence of perivulvar pores, which are present in the latter species.

Melanaspis lilacina is extremely rare in California having been collected thus far from only two localities in San Diego County.

California records:

San Diego Co.: Banner, 1939 (G. F. Ferris). Descanso, XI-39-55 (G. W. Schwegel and J. P. Dion).

Melanaspis obscura (Comstock)
Obscure scale
(Fig. 42)

Aspidiotus obscurus Comstock, 1881, Rep. U.S.-D.A. for 1880, p. 303, illus.

Aspidiotus (Melanaspis) obscurus (Comstock), Cockerell, 1897, Div. Ent. Bull. 6, Tech. Ser., U.S.D.A., pp. 13 and 21.

Chrysomphalus obscurus (Comstock), Leonardi. 1899, Riv. Patol. veg., 7:206.

Melanaspis obscura (Comstock), Keifer, 1941, Calif. Dept. Agri., mimeo. Fol. No. 12.

Melanaspis obscura (Comstock), Ferris, 1941, Atlas of Scale Insects, Ser. III:361.

Type locality: Washington, District of Columbia, United States of America.

Type host: *Quercus phellos,* willow oak.

Relation to host: Exposed on the bark of the host. Adult female scale dark gray, circular, flattened, exuviae subcentral and blackish; male scale somewhat smaller than the female and elongate elliptically.

Additional hosts: *Acer, Carya illinoensis, Castanea, Cornus, Corsicana, Hicoria pecan, Juglans, Prosopis, Prunus reverchoni, Quercus coccinea, Wuercus* spp., and *Vitis.*

Discussion:

This scale is the only other species of *Melanaspis* formerly represented, at least, in California. It was originally discovered infesting pecan in California during 1933 and was later the object of an intensive eradication program. Since 1941 no living specimens of this scale have been found in the state.

Melanaspis obscura is easily differentiated from *M. lilacina* (Cockerell) by the absence of perivulvar pores, these structures present in the latter species.

California records:

Los Angeles Co.: Van Nuys, III-3-33 (L. E. Myers).

San Diego Co.: El Cajon, VI-13-34. Flinn springs, I-22-35 (M. L. Jones). Lemon Grove, VI-22-34 (E. T. Gammon). Mt. Helix, VI-28-34 (E. T. Gammon and C. Gammon).

Nuculaspis californica (Coleman)
Black pine leaf scale
(Pl. 1, bottom row, right; fig. 43)

Aspidiotus abietis (Schrank), 1776, Beitrage zur Naturgeschichte Inseckten, p. 48 (as a misidentification).

Aspidiotus pini Comstock (not of Bouché) 1881,

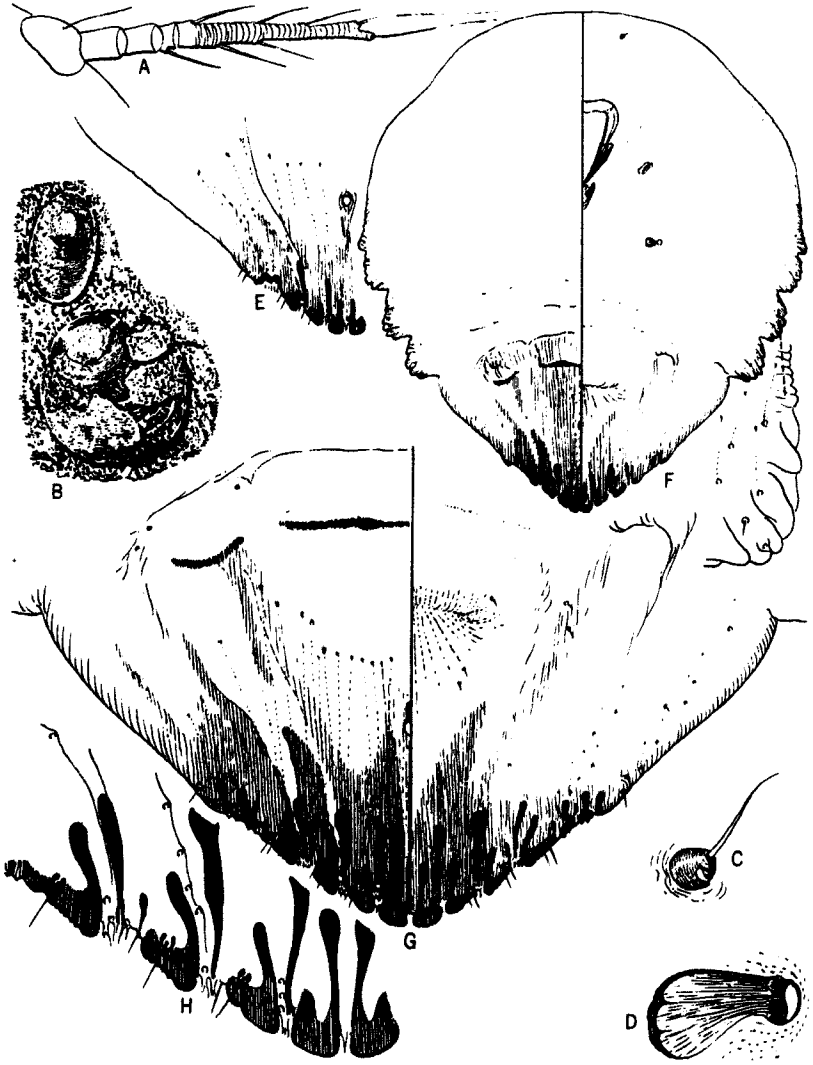

Fig. 41a. *Melanaspis lilacina* (Cockerell), dark oak scale.

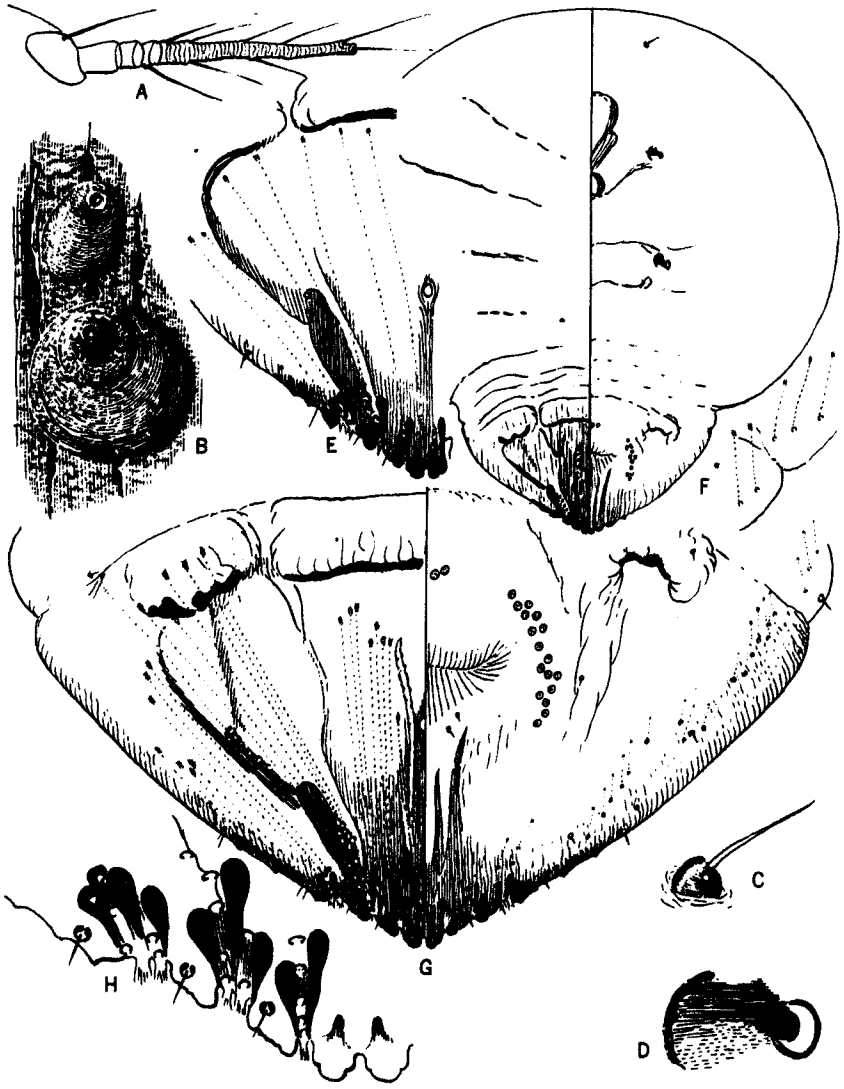

Fig. 42. *Melanaspis obscura* (Comstock), obscure scale.

Rep. U.S.D.A. for 1880, p. 306 illus. (Preoccupied by earlier *Aspidiotus pini* of Bouché).

Aspidiotus californicus Coleman, 1903, Jour. N.Y. Ent. Soc., 2:64, illus.

Nuculaspis californica (Coleman), Ferris, 1938, Atlas of Scale Insects, Ser. II:251.

Ferris (1938) states "The name *Aspidiotus pini* of Comstock was preoccupied by the much earlier *Aspidiotus pini* of Bouché.

"Comstock's species has at times been placed as a synonym of the European *Aspidiotus abietis* (Schrank), but if material from Italy identified by Leonardi as the latter species is correctly identified this cannot be the case."

Type locality: Cobb Mountain, Mount Hamilton Range, Santa Clara County, California.

Type host: *Pinus sabiniana,* digger pine.

Relation to host: Infesting the needles only. Adult female scale blackish-brown, elongate possibly owing to needle shape, exuviae centrally located; scale of the male darker, elongate oval, exuvia central.

Additional hosts: *Pinus cembroides, Pinus lambertiana, Pinus mitis, Pinus murrayana, Pinus ponderosa, Pinus radiata, Pinus rigida,* and *Pseudotsuga taxifolia.*

Discussion:

According to available literature, *Nuculaspis californica* is the only species of this genus in California. Superficially the species resembles *Aspidaspis florenciae* (Coleman), although the presence of a well-developed fourth pygidial lobe in *californica* readily separates the two forms.

Certain forested areas in Lassen and San Bernardino counties of California have been seriously damaged by this scale. In the summer of 1955 spray applications were made to control the species in the highly recreational areas of Crestline and Lake Arrowhead in southern California.

California records:

Alameda Co.: Livermore, XII-5-54 (E. K. Strobridge).

Butte Co.: Chico, III-18-44 (R. G. White).

Lassen Co.: Susanville, V-15-53 (E. T. Gammon).

Los Angeles Co.: Azusa, XI-6-44. Los Angeles, XI-6-44 (R. H. Smith).

Modoc Co.: Timber Mt., III-16-40 (J. W. Johnson).

Placer Co.: Colfax, VII-24-32 (Fourness).

Sacramento Co.: Sacramento, XII-19-34 (D. Custer).

San Bernardino Co.: Crestline, IV-18-40 (J. M. Miller and S. T. Carlson). Lake Gregory, VI-16-55 (H. L. McKenzie).

San Diego Co.: Pine Valley, VII-27-32 (W. V. Shear).

San Luis Obispo Co.: San Luis Obispo, II-18-48 (S. M. Mather and R. M. Drake).

Santa Clara Co.: Cobb Mountain, Mt. Hamilton Range, VI-1901 (G. A. Coleman). Palo Alto, IV-25-31 (H. H. Keifer).

Santa Cruz Co.: Santa Cruz, IV-10-34 (F. J. March).

Shasta Co.: Hat Creek, V-15-41 (H. L. McKenzie). McCloud, 1940 (G. F. Ferris).

Solano Co.: Fairfield, III-26-34 (O. A. Kurtz).

Sonoma Co.: IV-1-30 (Bremner).

Yolo Co.: Woodland, XI-8-37 (C. H. Hardy).

Quadraspidiotus forbesi (Johnson)
Forbes scale
(Fig. 44)

Aspidiotus forbesi Johnson, 1896, Ent. News, 7:151.

Aspidiotus (Diaspidiotus) forbesi Johnson, Cockerell, 1897. Div. Ent. U.S.D.A. Bull. 6, Tech. Ser., pp. 5 and 21.

Aspidiotus (Aspidiella) forbesi Johnson, Leonardi, 1898, Riv. Patol. veg., 6:223.

Aspidiotus fernaldi variety *hesperius* Cockerell, 1902, Ann. Mag. Nat. Hist., (7) 9:450.

Quadraspidiotus forbesi (Johnson), Ferris, 1938. Atlas of Scale Insects, Ser. II:256.

Type locality: Not specifically indicated in the original description. Recorded from various localities in Illinois. Ferris, 1938, suggests that Champaign may be selected.

Type host: Recorded as occurring principally on wild and cultivated cherry.

Relation to host: Occurring on the bark of its host. Adult female scale gray, elongate oval, high convex, the exuviae near one end; male scale elongate, exuvia near one end.

Additional hosts: Recorded from a long list of hosts a few of which include: *Carya illinoensis, Celtis, Cydonia oblonga, Ilex aquifolium, Ligustrum, Malus pumila, Prunus cerasus, Prunus* sp. (plum), and *Rhamnus.*

Discussion:

This species is rather closely related to *Quadraspidiotus perniciosus* (Comstock) from which it differs most conspicuously in the presence of perivulvar pores. It may be differentiated from the other California species, *Q. juglans-regiae* (Comstock), in the presence of a membraneous prosoma as compared to derm sclerotization of this area in the latter form.

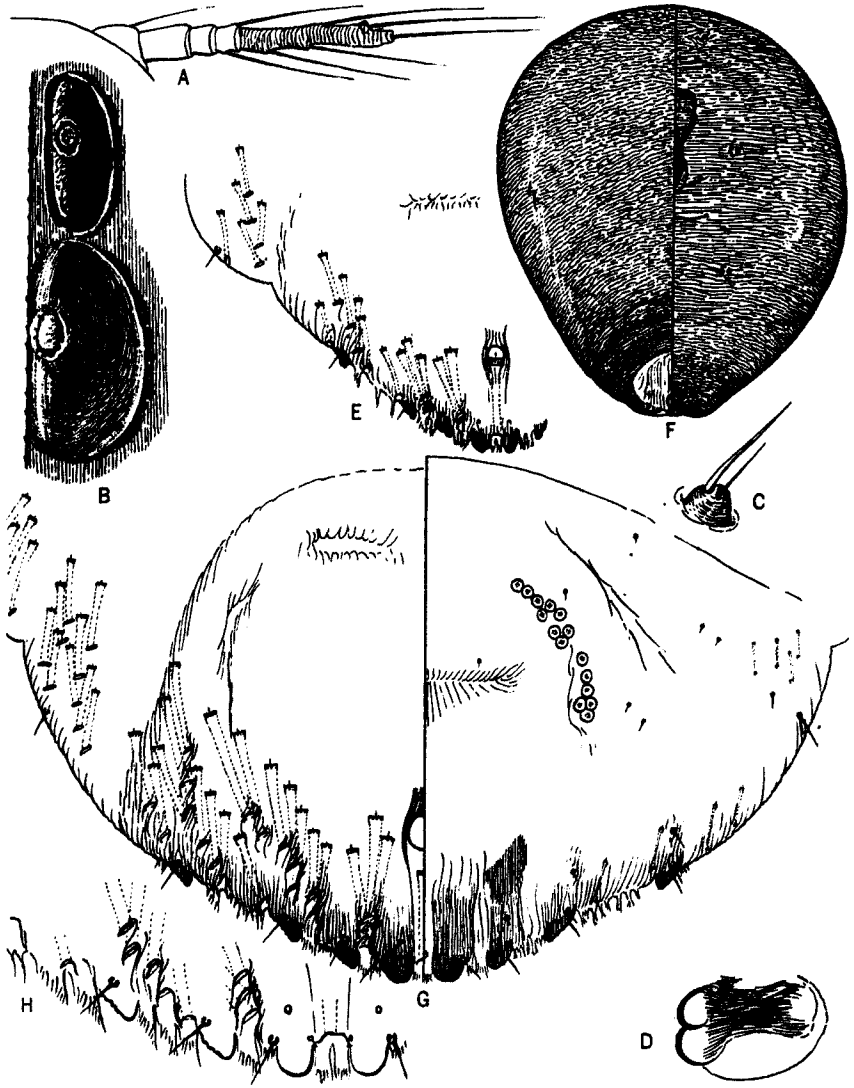

Fig. 43. *Nuculaspis californica* (Coleman), black pine leaf scale.

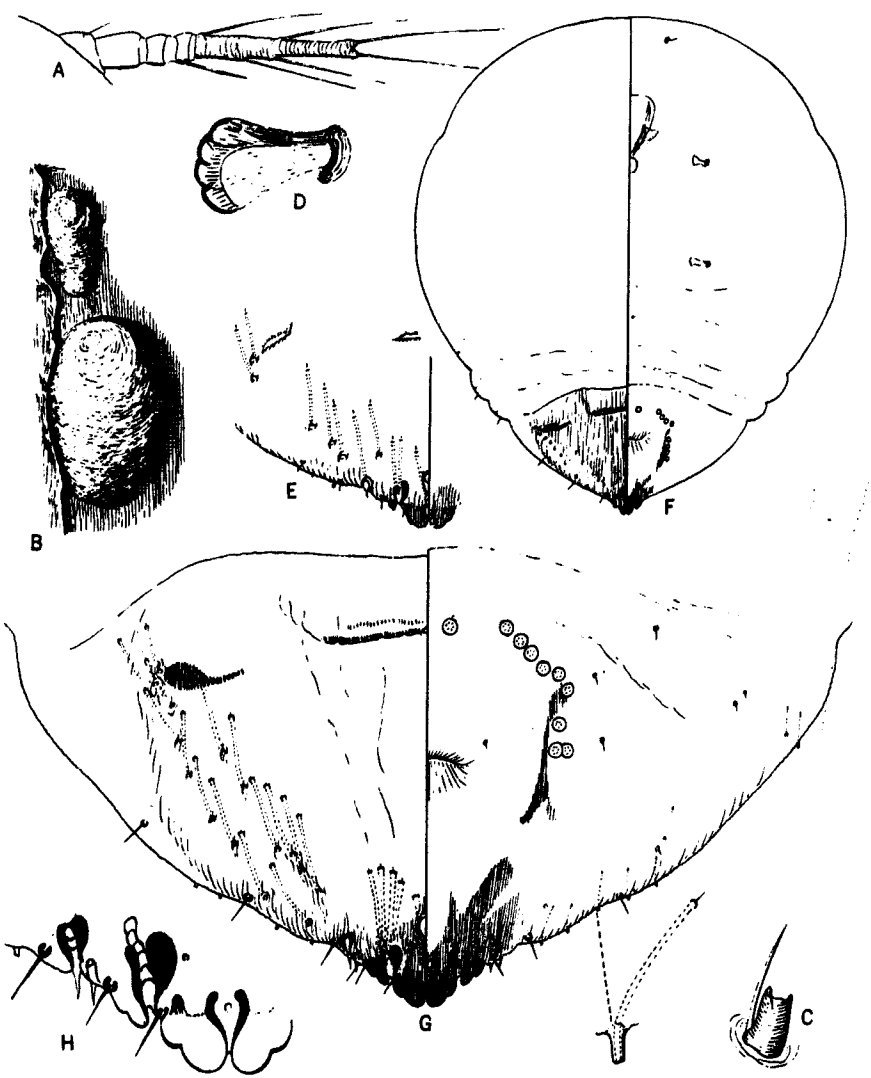

Fig. 44. *Quadraspidiotus forbesi* (Johnson), Forbes scale.

California records:

Kings Co.: Hanford, III-11-41 (T. B. Gallion).

Sacramento Co.: Mayhews, V-9-35 (M. L. Jones and H. H. Keifer). Sacramento, VII-16-47 (J. W. Dixon).

Tulare Co.: Porterville, XII-20-50 (O. A. Hemphill). Visalia, I-4-41 (O. A. Hemphill).

Yolo Co.: Davis, III-7-47 (E. T. Gammon). Woodland, IV-30-37 (S. L. Lockwood).

Quadraspidiotus juglans-regiae (Comstock)
Walnut scale
(Pl. 2, top row, left; fig. 45)

Aspidiotus juglans-regiae Comstock, 1881, Rep. U.S.D.A. for 1880, p. 300, illus.

Aspidiotus juglans-regiae variety *pruni* Cockerell, 1894, Canad. Ent., 26:132.

Aspidiotus juglans-regiae variety *albus* Cockerell, 1894. Canad. Ent., 26:132.

Aspidiotus fernaldi Cockerell, 1898, Ann. Mag. Nat. Hist., 7(2):323.

Aspidiotus fernaldi variety *albiventer* Hunter, 1899, Kans. Univ. Quart., 8:6.

Aspidiotus fernaldi variety *cockerelli* Parrott, 1899, Canad. Ent., 31:10.

Aspidiotus glanduliferus Cockerell, 1902, Ohio Nat., 2:287.

Quadraspidiotus juglans-regiae (Comstock), Ferris, 1938, Atlas of Scale Insects, Ser. II:257.

Type locality: Los Angeles, Los Angeles County, California.

Type host: *Jugland regia,* English walnut.

Relation to host: Occurring on the bark. Adult female scale gray, almost circular or slightly oval, moderately convex, exuviae subcentral; male scale similar in color to that of adult female, elongate oval, exuvia near one end.

Additional hosts: This species has been reported from a long list of hosts throughout the United States. A few of these hosts include: *Adelia neomexicana, Betula, Cornus, Fraxinus, Juglans* spp., *Photinia arbutifolia, Pinus, Prunus persica, Rosa, Salix, Ulmus, Vitis,* and *Zanthoxylum.*

Discussion:

In this species, the constriction between mesothorax and metothorax is distinctly marked, and the prosoma is heavily sclerotized. These characteristics readily differentiate it from the other two California species, *Quadraspidiotus forbesi* (Johnson) and *Q. perniciosus* (Comstock).

California records:

Alameda Co.: Oakland, V-1-40 (G. B. Laing).

Contra Costa Co.: Walnut Creek, X-11-43 (Weimer and Anderson).

Inyo Co.: Lone Pine, IV-25-39 (J. W. Dixon).

Kern Co.: Bakersfield, V-5-41 (J. W. Dixon). Oildale, XII-28-38 (J. R. Clark). Shafter, II-19-35 (C. S. Morley).

Los Angeles Co.: Baldwin Park, II-15-44 (Cameron, Roof, Byers). Los Angeles, VII-20-35 (C. R. Tower). Montebello, V-11-36 (C. R. Tower). Pomona, IV-4-35. San Gabriel Canyon, III-12-33 (C. R. Tower).

Orange Co.: Anaheim, IV-20-39 (R. J. Bumgardner). Orange, I-4-32 (C. Kilgore).

Riverside Co.: Perris, XI-10-43 (F. R. Platt).

San Bernardino Co.: Fontana, IV-6-37 (G. A. Pohl). Ontario, II-5-44 (C. R. Tower).

San Diego Co.: El Cajon, VI-22-34. Rancho Santa Fe, VI-28-34 (E. T. Gammon). San Diego, III-4-35 (E. T. Gammon).

Ventura Co.: Camarillo, XI-30-39 (C. Gammon). Oxnard, IV-27-33 (Stratton). Ventura, IV-26-33 (L. E. Myers).

Quadraspidiotus perniciosus (Comstock)
San Jose scale
(Pl. 2, top row, center, fig. 46)

Aspidiotus perniciosus Comstock, 1881, Rep. U.S.D.A. for 1880, p. 304, illus.

Aspidiotus (Diaspidiotus) perniciosus Comstock, Cockerell, 1897, Div. Ent., U.S.D.A., Bull. 6, Tech. Ser., p. 30.

Aonidiella pernicosa (Comstock), Berlese and Leonardi, 1898. Chermotheca Italica, 3:53.

Comstockaspis perniciosa (Comstock), MacGillivray, 1921, The Coccidae, p. 438.

Quadraspidiotus perniciosus (Comstock), Ferris, 1938, Atlas of Scale Insects, Ser. II:259.

Type locality: Santa Clara County, California.

Type host: Originally described from examples collected from "apple, pear, plum and other trees."

Relation to host: Occurring primarily on the bark, although it may commonly infest the fruit and infrequently the leaves. Adult female scale gray, circular, slightly convex, exuviae subcentral; male scale similar in color to that of adult female, slightly elongate, exuvia near one end.

Additional hosts: Even though this species seems especially to prefer deciduous trees, it has been recorded from a long list of host plants, a few of which are here included: *Acacia, Aloe, Azalea, Buxus, Citrus, Cotoneaster, Crataegus,*

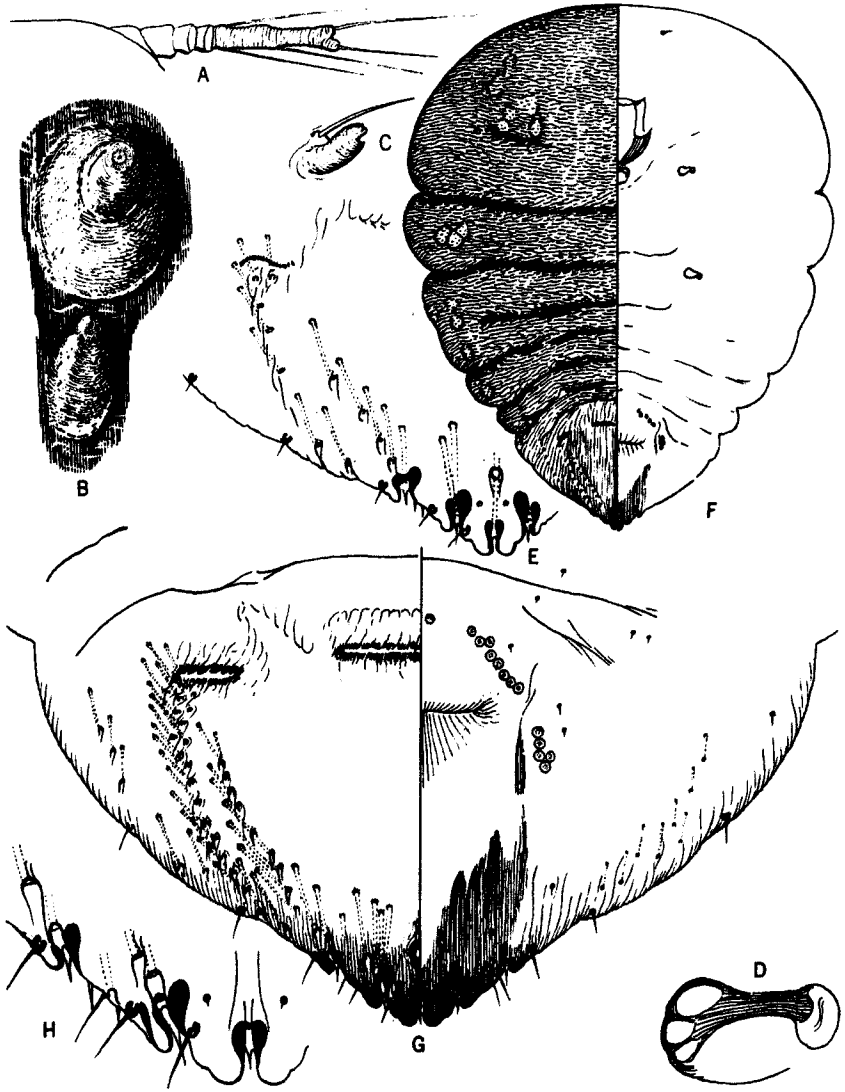

Fig. 45. *Quadraspidiotus juglans-regiae* (Comstock), walnut scale.

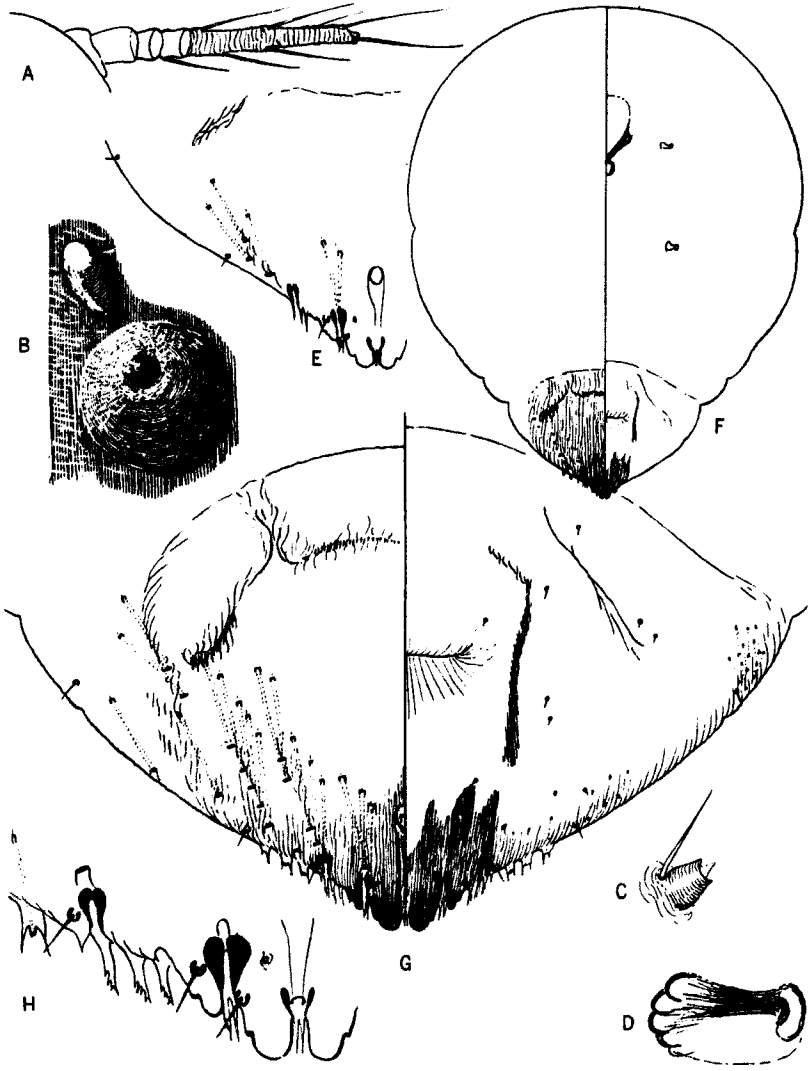

Fig. 46. *Quadraspidiotus perniciosus* (Comstock), San Jose scale.

Hedera, Juglans, Nerium, Persea, Pinus, Pyracantha, Olea, Rosa, Tamarix, Ulmus, and *Vitis.*

Discussion:

This species is very similar to *Quadraspidiotus forbesi* (Johnson), from which it differs chiefly in the absence of perivulvar pores.

California records:

This species is very generally distributed throughout California. A few records taken from authentically determined specimens in the California State Department of Agriculture collection are here included:

Butte Co.: Chico, III-16-36 (E. H. Fosen). Durham, IV-20-36 (R. Swett).

Fresno Co.: Fresno, V-30-35 (E. H. Fosen and M. L. Jones).

Los Angeles Co.: Los Angeles, I-3-39 (M. R. Bell).

Merced Co.: Gustine, III-2-40 (A. J. Dunlap).

Orange Co.: Santa Ana, XII-22-37 (R. J. Bumgardner).

Placer Co.: Baxter's, I-2-39 (J. B. Steinweden). Newcastle, X-19-36 (S. L. Lockwood).

Sacramento Co.: Auburn, VIII-30-37 (H. E. Catlin). Folsom, IX-28-37 (W. Travioli). Sacramento, XI-12-28 (P. H. Fahle). Walnut Grove, XI-9-34 (A. E. Morrison).

San Diego Co.: Escondido, V-28-36 (S. B. Osborn). San Diego, II-20-35 (J. O. Brodeur).

San Joaquin Co.: Lodi, II-26-37 (S. L. Lockwood). Stockton, V-25-37 (P. F. Wright).

Santa Cruz Co.: Santa Cruz, V-23-35 (C. V. Dick). Watsonville, I-1933 (A. C. Browne).

Sutter Co.: Yuba City, XII-21-33 (T. D. Urbans).

Tulare Co.: Orosi, XII-13-40 (S. L. Lockwood).

Ventura Co.: Camarillo, II-27-36 (E. L. Smith). Oxnard, VII-28-39 (C. Gammon). Santa Paula, IV-10-40 (R. A. Young).

Yolo Co.: Davis, I-8-35 (C. H. Hardy). Woodland, I-9-35 (C. H. Hardy).

Yuba Co.: Marysville, II-22-35 (H. A. Crane).

Rhizaspidiotus dearnessi (Cockerell)
Dearness scale
(Fig. 47)

Aspidiotus dearnessi Cockerell, 1898, Canad. Ent., 30:226.

Targionia dearnessi (Cockerell), Leonardi, 1901, Riv. Patol. veg., 8:343.

Remotaspidiotus dearnessi (Cockerell), MacGillivray, 1921, The Coccidae, p. 434.

Aspidiotus (Targionia) gutierreziae Cockerell and Parrott, 1899, Industrialist, pp. 277-282.

Targionia gutierreziae (Cockerell and Parrott), Leonardi, 1901, Riv. Patol. veg., 8:343-344.

Chorizaspidiotus gutierreziae (Cockerell and Parrott), MacGillivray, 1921, The Coccidae, p. 432.

Aspidiotus (Targionia) helianthi Parrott, 1899, Canad. Ent., 31:176.

Rhizaspidiotus helianthi (Parrott), MacGillivray, 1921, The Coccidae, p. 431.

Rhizaspidiotus dearnessi (Cockerell), Ferris, 1938, Atlas of Scale Insects, Ser. II:263.

Type locality: Bruce Peninsula, Ontario, Canada.

Type host: *Arctostaphylos uva-ursi,* bearberry.

Relation to host: Ferris (1938) states that this species occurs on the crowns and stems, and at times below the ground surface. Adult female scale gray or brownish, circular, convex, exuviae central, and with a strong ventral scale formed; male scale elongate, brown, exuvia near one end.

Additional hosts: *Ambrosia, Aplopappus heterophyllus, Aplopappus laricifolius, Aplopappus linearifolius, Artemisia filifolia, Aster, Baccharis pilularis, Ceanothus americana,* Composite, *Corethrogyne, Eriogonum fasciculatum, Franseria dumosa, Grindelia cuneifolia, Gutierrezia lucida, Helianthus, Larrea, Parthenium incanum,* and *Viguiera tenuifolia.*

Discussion:

This is the only species of the genus known to occur in California. There appears to be considerable variation in the shape of the pygidium as well as in the prominence of the crenulations along the pygidial margins. The number of macroducts appear also to vary considerably.

California records:

Kern Co.: Coalinga, XI-3-49 (H. Wallace). Roscoe, III-17-36 (L. E. Myers). Sanger, IV-16-34 (L. E. Myers). Semmler.

Los Angeles Co.: Azusa, IV-21-34 (L. E. Myers). Lancaster (near), IV-26-36 (G. F. Ferris).

Monterey Co.: Pacific Grove (G. F. Ferris).

Riverside Co.: Coachella, II-12-36 (F. S. Stickney).

San Mateo Co.: Pigeon Point (G. F. Ferris).

Santa Clara Co.: Palo Alto (G. F. Ferris).

Tulare Co.: Mineral King, VIII-25-46 (G. F. Ferris).

Selenaspidus albus McKenzie
White euphorbia scale
(Pl. 2, top row, right; fig. 48)

Selanaspidus albus McKenzie, 1953, Calif. Dept. Agric. Bull. 42:53-56, illus.

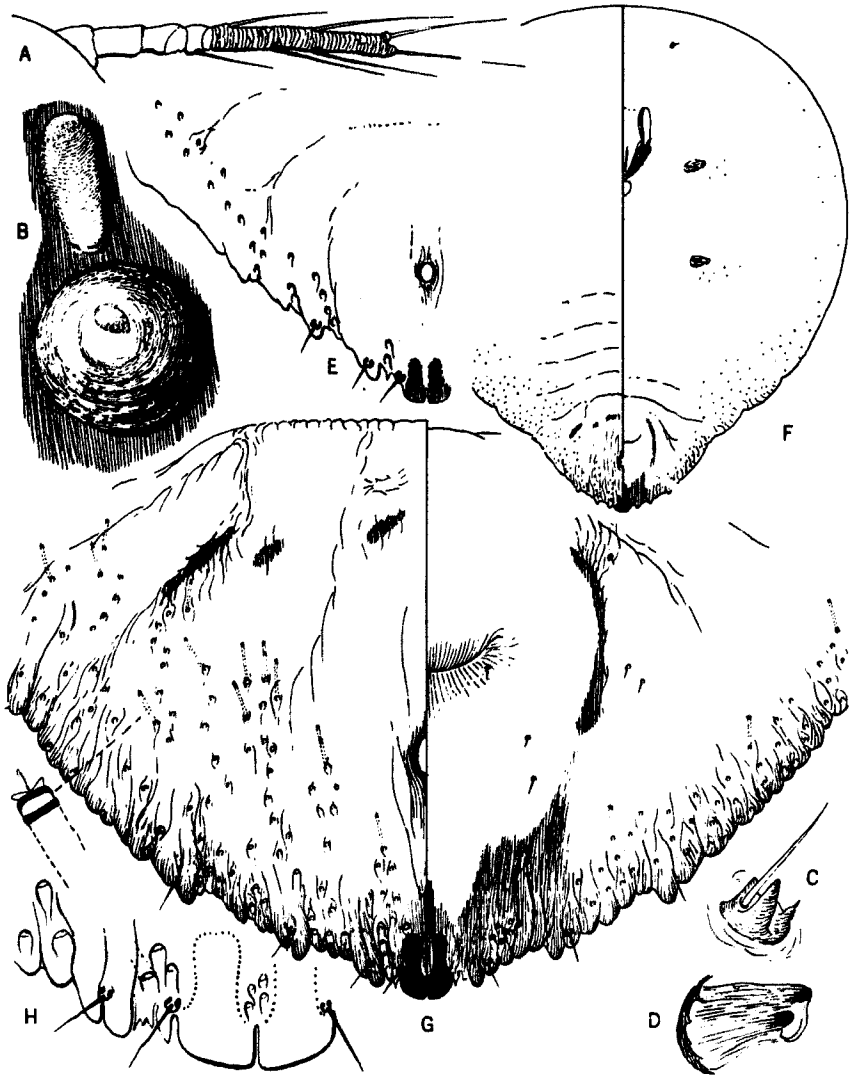

Fig. 47. *Rhizaspidiotus dearnessi* (Cockerell), Dearness scale.

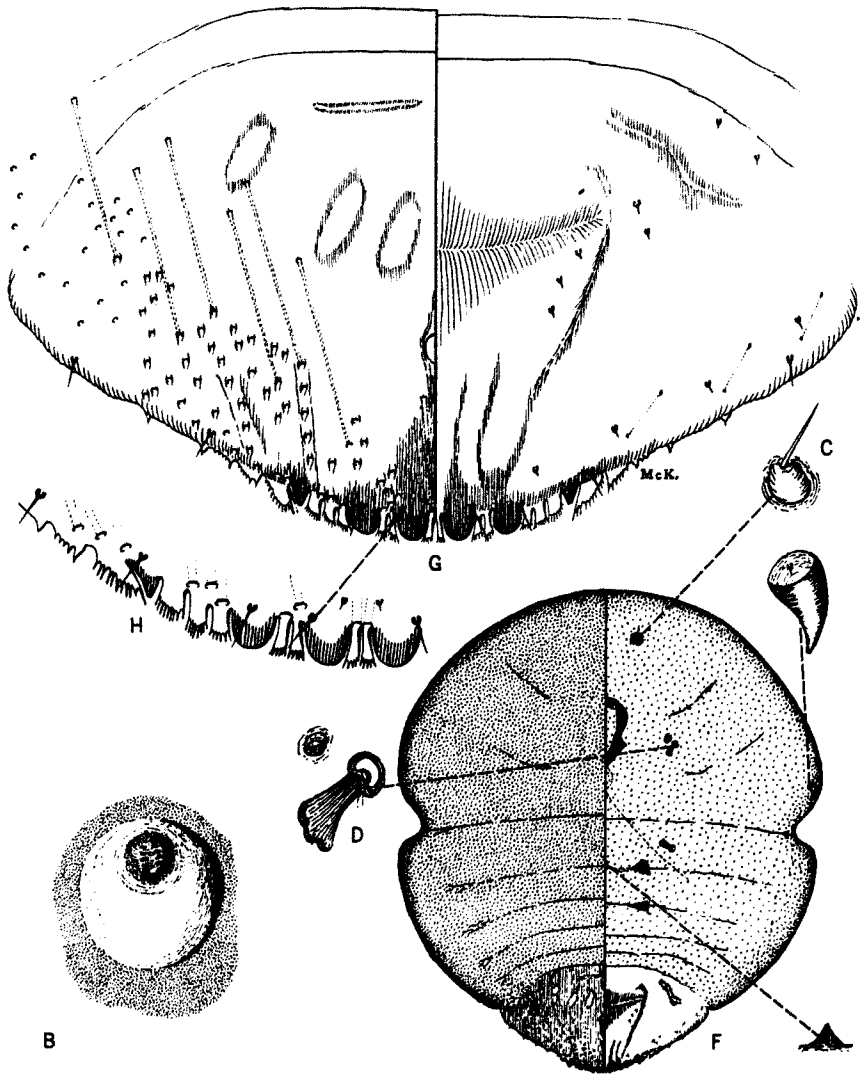

Fig. 48. *Selenaspidus albus* McKenzie, white euphorbia scale.

Type locality: Norco, Riverside County, California.

Type host: *Euphorbia Caput-Medusae* (Euphorbiaceae).

Relation to host: Occurring on the leaves. Scale of the female circular, white, with yellowish-brown subcentral exuviae; male scale not observed.

Additional hosts: *Euphorbia captiosa, E. fimbratum, E. polygona, E. pulvinata, E. submammillaris,* and *E. truncata.*

Discussion:

This species may be differentiated from *Selenaspidus rubidus* McKenzie by the character of the median and second pygidial lobes, which are approximately the same size and shape and are smoothly rounded, together with the presence of a prominent ventral submarginal sclerotized prosomal spur. In *Selenaspidus rubidus* the second pygidial lobes are noticeably smaller than the median ones, and both exhibit notching; also instead of a submarginal prosomal spur there is evident in this position a sclerotized boss.

This scale has caused considerable damage to *Eupharbia* grown commercially. Heavily infested plants are usually destroyed by burning.

California records:

Los Angeles Co.: La Cañada, III-12-46 (M. Wagner). Los Angeles, IV 23-34 (G. A. Fricke). Riverside Co.: Norco, IX-19-44 (F. R. Platt). San Diego Co.: Carlsbad, X-14-47 (D. F. Palmer). Escondido, II-8-46 (C. E. Ehmann).

Selenaspidus articulatus (Morgan)
Rufous scale
(Fig. 49)

Aspidiotus articulatus Morgan, 1889, Ent. Mon. Mag., 25:352.

Aspidiotus (Selenaspidus) articulatus Morgan, Div. Ent., U.S.D.A. Bull. 6, Tech. Ser. 14:23.

Selenaspidus articulatus (Morgan), Leonardi, 1898, Riv. Patol. veg., 6:211.

Pseudaonidia articulata (Morgan), Marlatt, 1907, Proc. Ent. Soc. Wash., 10:135, illus.

Pseudaonidia articulata variety *simplex* de Charmoy, Marlatt, 1907, Proc. Ent. Soc. Wash., 10:135-136.

Selenaspidus articulatus (Morgan), Ferris, 1938, Atlas of Scale Insects, Ser., II:265.

Type locality: Demerara, British Guiana.

Type host: *Dictyosperma album,* white princess palm.

Relation to host: Occurring principally on the leaves, fruit, and green twigs. Larger twigs and branches are less affected. Adult female scale flat, circular, pale brown, the centrally placed exuviae being darker; male scale almost white, oval; exuvia subcentral.

Additional hosts: This scale has been recorded from a wide variety of hosts from around the world in tropical and subtropical regions. A few of the hosts are here listed: *Citrus, Cocos nucifera, Croton, Cycas circinalis, Gardenia, Mangifera indica, Nerium oleander, Olea, Persea,* and *Rosa.*

Discussion:

This species is easily separated from our other California *Selenaspidus* by the presence of perivulvar pores. Only one nursery infestation of this scale has been found in California. Apparently the infested plants (Croton) had escaped detection in the nursery for a period of almost one year. The infestation was eradicated during March, 1947, by the California State Nursery Service.

California records:

Alameda Co.: Oakland, III-21-47 (G. B. Laing and S. M. Mather) (in a nursery).

Selenaspidus rubidus McKenzie
Brownish euphorbia scale
(Fig. 50)

Selenaspidus rubidus McKenzie, 1953, Calif. Dept. Agri. Bull., 42:57-58, illus.

Type locality: San Diego, San Diego County, California.

Type host: *Euphorbia fasciculata* (Euphorbiaceae).

Relation to host: Occurring on the leaves. Scale of the female essentially circular, of a uniform brownish color, exuviae subcentral, generally darker; male scale not observed.

Additional hosts: *Euphorbia captiosa, E. Caput-Medusae, E. mammillaris,* and *E. tuberculata.*

Discussion:

This species is allied to *Selenaspidus albus* McKenzie but differs from it in having the second pair of pygidial lobes noticeably smaller than median lobes and both pairs notched on either side. In *Selenaspidus albus* the first and second pygidial lobes are approximately equal in size and are smoothly rounded. *S. rubidus* possesses a ventral submarginal sclerotized boss on prosoma instead of a spur.

California records:

Los Angeles Co.: Los Angeles, VII-16-37 (L. E. Myers).

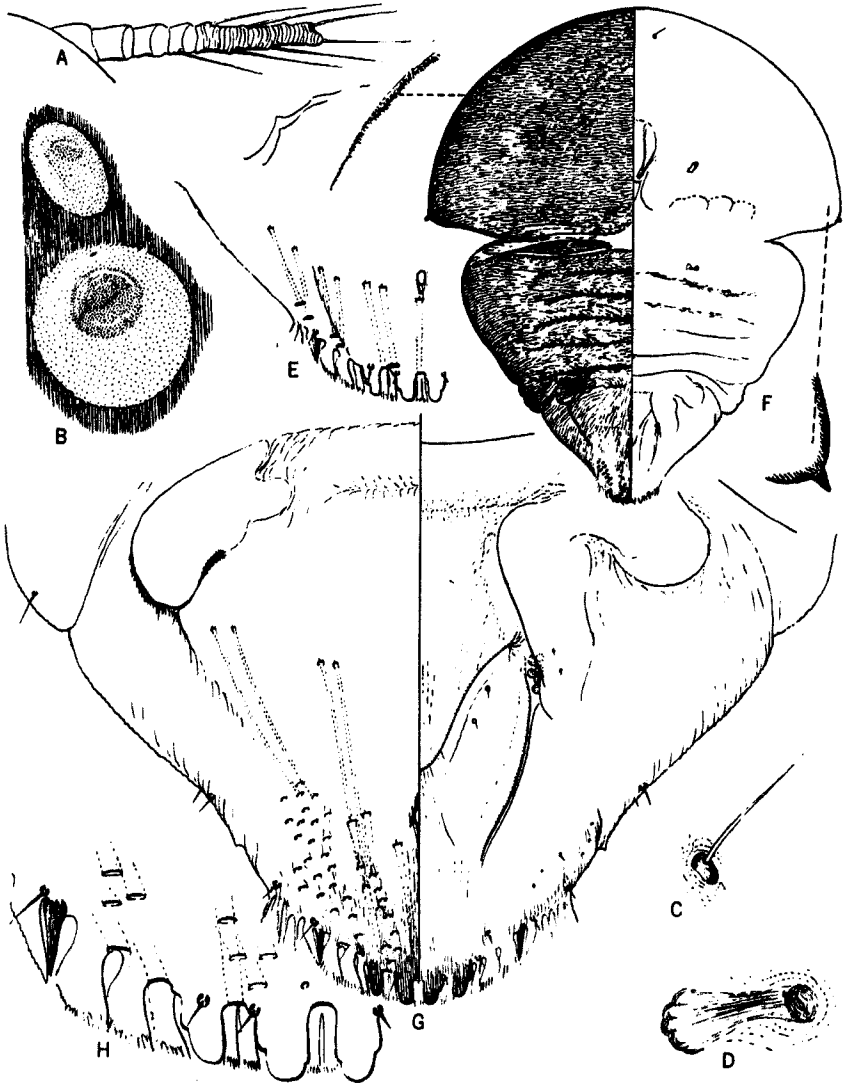

Fig. 49. *Selenaspidus articulatus* (Morgan), rufous scale.

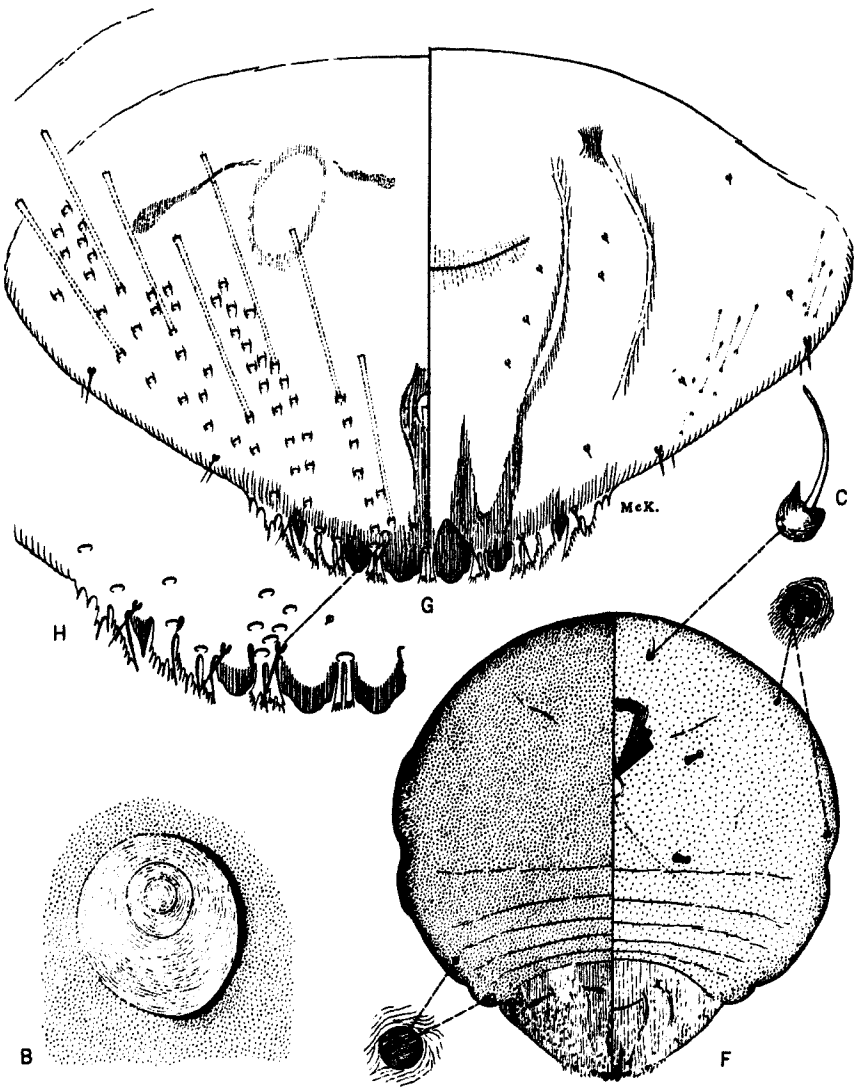

Fig. 50. *Selenaspidus rubidus* McKenzie, brownish euphorbia scale.

San Diego Co.: San Diego, VII-29-44 (C. E. Ehmann).

Ventura Co.: Ojai District, VII-7-48 (V. Holmer).

Targionia bigeloviae (Cockerell)
Bigelovia scale
(Fig. 51)

Aspidiotus (Hemiberlesia) bigeloviae Cockerell, 1897, U.S.D.A. Div. Ent. Bull. 6, Tech. Ser., p. 20.

Leonardianna bigeloviae (Cockerell), MacGillivray, 1921, The Coccidae, p. 450.

Targionia bigeloviae (Cockerell), Ferris, 1938, Atlas of Scale Insects, Ser. II:267.

Type locality: Los Angeles, Los Angeles County, California.

Type host: *Bigelovia brachylepis.*

Relation to host: Occurring on the stems and crowns. Adult female scale circular, bright reddish-brown except for whitish exuviae, rather flat, exuviae subcentral; male scale similar in color to that of adult female, elongate, exuvia near one end.

Additional hosts: *Gutierrezia,* and *Lepidospartum squamatum.*

Discussion:

This species resembles *Targionia yuccarum* (Cockerell), known from southwestern United States, but differs in having smaller pygidial lobes and poorer developed scleroses at the bases of pygidial lobes.

California records:

Inyo Co.: Deep Springs, III-23-37 (G. F. Ferris).

Los Angeles Co.: Los Angeles (L. E. Myers). San Dimas, III-11-29.

Santa Barbara Co.: Cuyama Valley, III-30-35 (G. F. Ferris).

Tribe DIASPIDINI

The genera and species of California Diaspidini are arranged alphabetically.

Aonidomytilus bilobis Ferris
Bilobed scale
(Fig. 52)

Aonidomytilus bilobis Ferris, 1941, Atlas of Scale Insects, Ser. III:272..

Type locality: Near Tranquillity, Fresno County, California.

Type host: *Allenrolfea occidentalis* (Chenopodiaceae).

Relation to host: Occurring on the stems of the host, generally quite near the ground. Adult female scale white, elongate; scale of the male smaller although of similar color and form to that of female.

Additional hosts: *Atriplex* sp.

Discussion:

This species is very closely allied to *Aonidomytilus variabilis* Ferris, from which it differs in the absence of perivulvar pores, and in having the dorsal pygidial macroducts of a uniform size.

California records:

Fresno Co.: Tranquillity (near), III-1939 (G. F. Ferris).

Inyo Co.: Deep Springs, X-1928 (G. F. Ferris).

Aonidomytilus ceanothi (Ferris)
Ceanothus scale
(Pl. 2, middle row, left; fig. 53)

Lepidosaphes ceanothi Ferris, 1919, Stanford Univ. Publ., pp. 62-63, illus.

Mytilaspis concolor Cockerell, Essig, 1909, Pomona Coll. Jour. Ent. 1:57 (misidentification).

Aonidomytilus ceanothi (Ferris), Ferris, 1937. Atlas of Scale Insects, Ser. I:6.

Type locality: Mount Tamalpais, Marin County, California.

Type host: *Ceanothus jepsoni.*

Relation to host: Occurring on the bark of the host. Adult scale of both sexes white and elongate.

Additional hosts: *Betula alba, Ceanothus glinosus* variety?, *Ceanothus integerrimus,* and *Ceanothus* spp., *Cercocarpus.*

Discussion:

This species is distinguishable from all other known species of the genus by the very great reduction of the pygidial gland spines, and by the much reduced, irregular, and inconspicuous median and second pygidial lobes.

California records:

Butte Co.: Oroville, III-15-27 (L. E. Myers).

El Dorado Co.: Larson Valley, XII-29-54 (L. Mobley and S. Lockwood). Placerville, XII-23-47 (C. E. Browning).

Imperial Co.: Imperial Valley, III-20-26 (F. Bingham).

Kern Co.: Kernville (above), III-28-50 (G. F. Ferris).

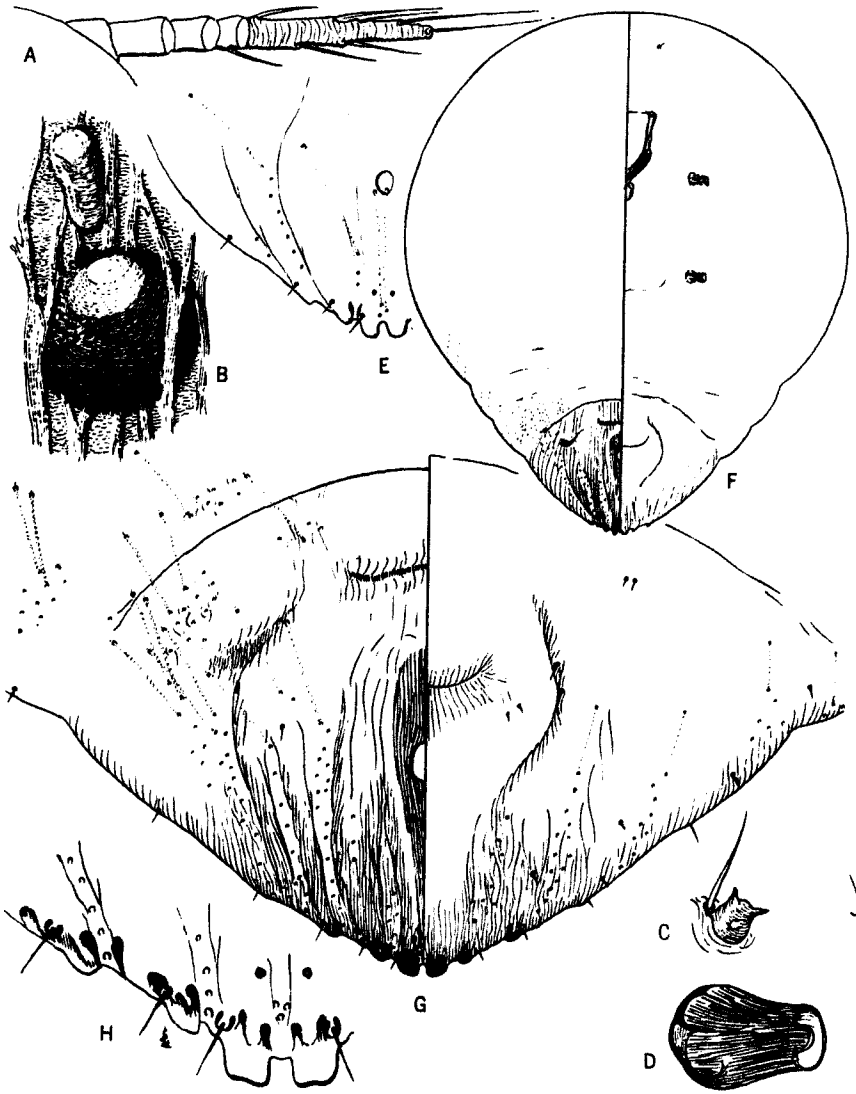

Fig. 51. *Targionia bigeloviae* (Cockerell), Bigelovia scale.

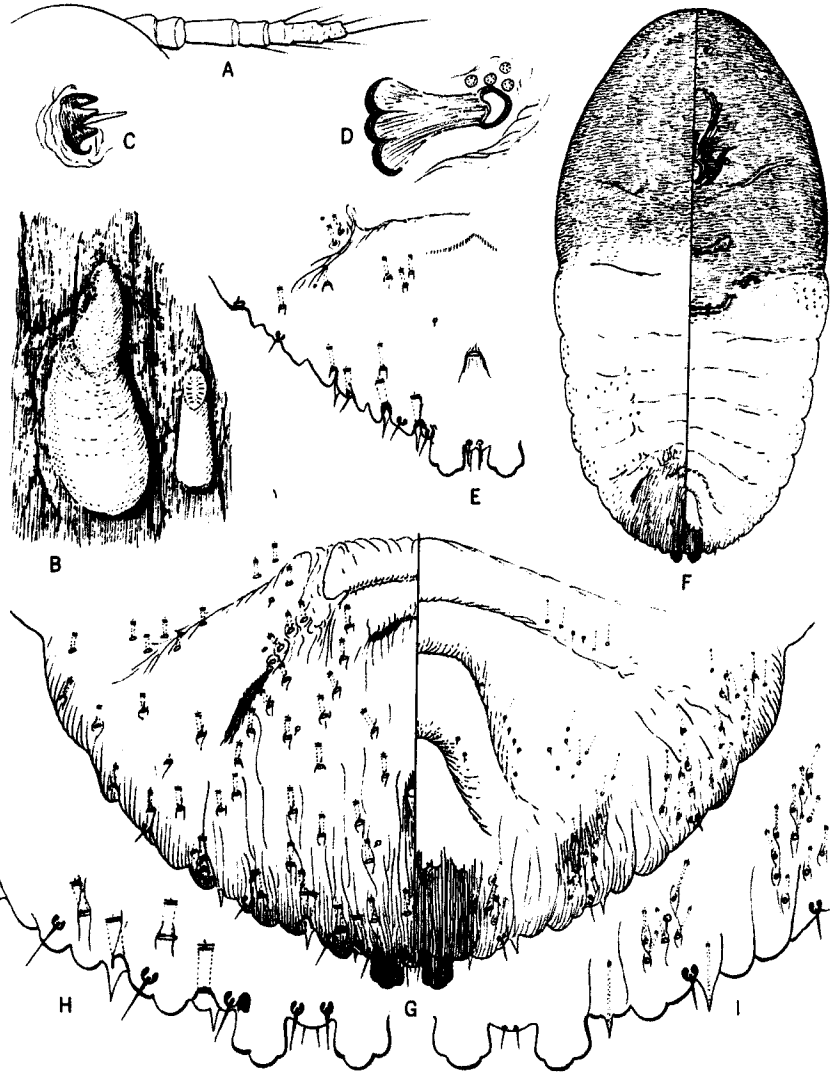

Fig. 52. *Aonidomytilus bilobis* Ferris, bilobed scale.

Lake Co.: Kelseyville, II-22-43 (P. S. Lange).
Madera Co.: Chowchilla, VI-23-42 (D. Holler). North Fork, VII-29-42 (E. T. Gammon).
Marin Co.: Mount Tamalpais, 1918 (G. F. Ferris).
Nevada Co.: Grass Valley, IV-19-48 (W. H. Brooks).
Orange Co.: Garden Grove, I-9-38 (J. B. Steinweden).
Placer Co.: Dutch Flat, I-9-38 (J. B. Steinweden).
Shasta Co.: Redding, IX-19-08 (R. W. Doane).
Ventura Co.: Santa Paula, V-14-48 (J. L. Schall).

Aonidomytilus concolor (Cockerell)
Concolor scale
(Fig. 54)

Mytilaspis albus variety *concolor* Cockerell, 1893, Psyche, 6:572.
Mytilaspis concolor variety *viridissima* Cockerell and Parrott, 1899, Industrialist, p. 276.
Lepidosaphes concolor (Cockerell), Ferris, 1919, Stanford Univ. Publ., pp. 60-61, illus.
Aonidomytilus concolor (Cockerell), Ferris, 1937, Atlas of Scale Insects, Ser. I:7.
Type locality: Las Cruces, New Mexico.
Type host: "chenopodiaceous plant" (probably an *Atriplex*).
Relation to host: Occurring normally on the stems. Adult female scale white or slightly greenish, elongate; male scale similar in form and color.
Additional hosts: *Aplopappus laricifolius, Atriplex, Borrichia frutescens, Encelia farinosa,* "ericaceous plant," *Franseria, Pedilanthus macrocarpa,* and *Suaeda.*
Discussion:
This species may be differentiated from *Aonidomytilus ceanothi* (Ferris) by its well-developed gland spines which frequently accommodate two or three ducts, whereas in the latter form these gland spines are exceedingly minute.
California records:
Fresno Co.: Panoche Creek, IV-28-49 (J. W. Dixon).
Imperial Co.: Algodones, XII-11-44, (A. J. Hanson and C. G. Anderson). Andrade, III-30-45 (A. J. Hanson and C. G. Anderson).
Inyo Co.: Independence, XII-18-40.
San Diego Co.: San Diego, III-4-32.

Aonidomytilus variabilis Ferris
Variable scale
(Fig. 55)

Aonidomytilus variabilis Ferris, 1938, Atlas of Scale Insects, Ser. II:138.
Type locality: Near Roscoe, San Fernando Valley, Los Angeles County, California.
Type host: *Sambucus* sp., elderberry.
Relation to host: Occurring in the bark cracks. Adult female scale white or pale brown, elongate, slender and irregular probably owing to conforming to its surroundings; male scale smaller but similar in color and shape to that of adult female.
Additional host: *Catalpa.*
Discussion:
This species is rather closely related to *Aonidomytilus bilobis* Ferris from which it differs chiefly in having perivulvar pores and dorsal pygidial macroducts of variable size.
California records:
Los Angeles Co.: Glendale, X-25-48 (H. Marsh). Roscoe, V-3-35 (L. E. Myers).
San Bernardino Co.: Highland, X-19-49 (G. M. Harper) (in nursery).
San Diego Co.: Banner, III-1939 (G. F. Ferris).

Aulacaspis rosae (Bouché)
Rose scale
(Pl. 2, middle row, center; fig. 56)

Aspidiotus rosae Bouché, 1834. Naturgeschichte des Inseckten, p. 14.
Diaspis rosae (Bouché), Signoret, 1869, Ann. Soc. ent. Fr., Ser. 4:9, p. 44, illus.
Aulacaspis rosae (Bouché), Cockerell, 1896, Bull. Bot. Dept. Jamaica, 3:259.
Aulacaspis rosae (Bouché), Ferris, 1936, Atlas of Scale Insects, Ser. I:10.
Aulacaspis rosae (Bouché), Scott, 1952, Microentomology, 17(2):40, illus.
Type locality: Europe.
Type host: *Rosa* sp., rose.
Relation to host: Occurring on the stems of the host. Adult female scale circular, flat and white, with a subcentral exuviae; male scale elongate, white, carinated and felted, with exuvia at one end.
Additional hosts: Commonly found on closely related members of the Rosaceae, including such plants as raspberry and blackberry.
Discussion:
This the only known species of *Aulacaspis* in North America. It is immediately separable from somewhat similar species of *Chionaspis* and *Phenacaspis* by the angular form of the prosoma, which is also swollen and exceeds the postsoma in width.
California records:
This species is very generally distributed

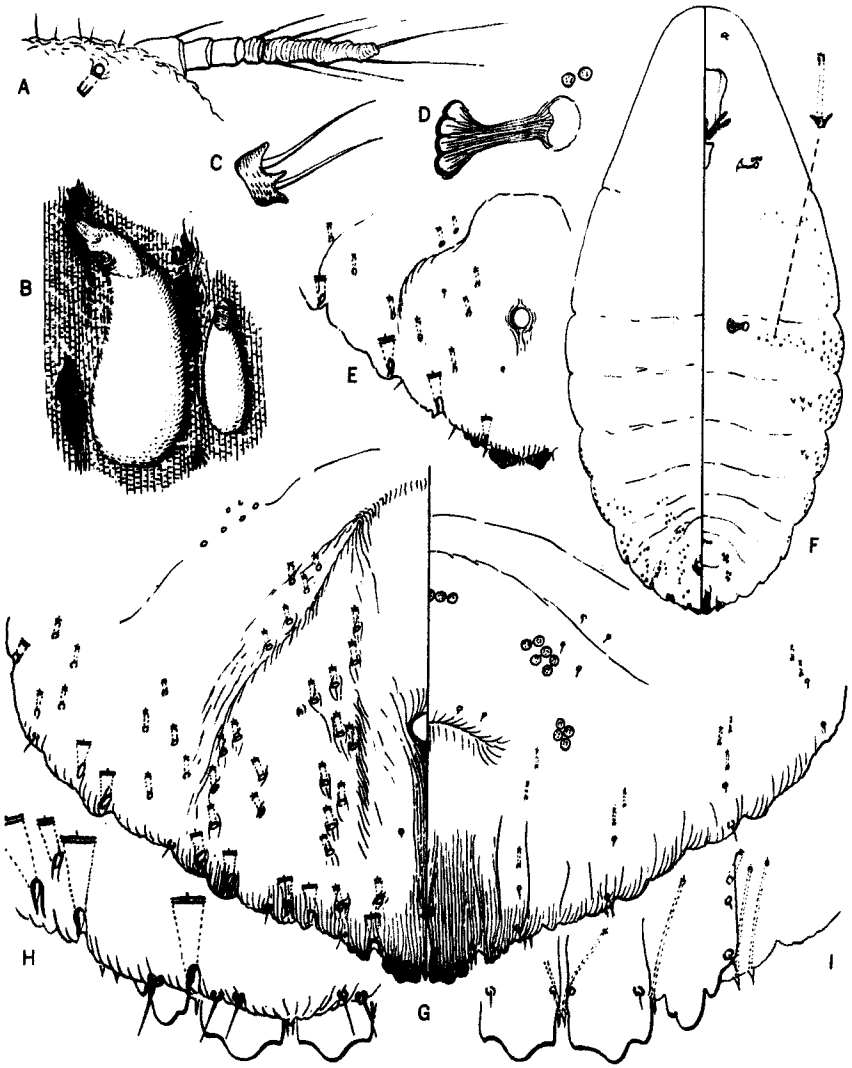

Fig. 53. *Aonidomytilus ceanothi* (Ferris), Ceanothus scale.

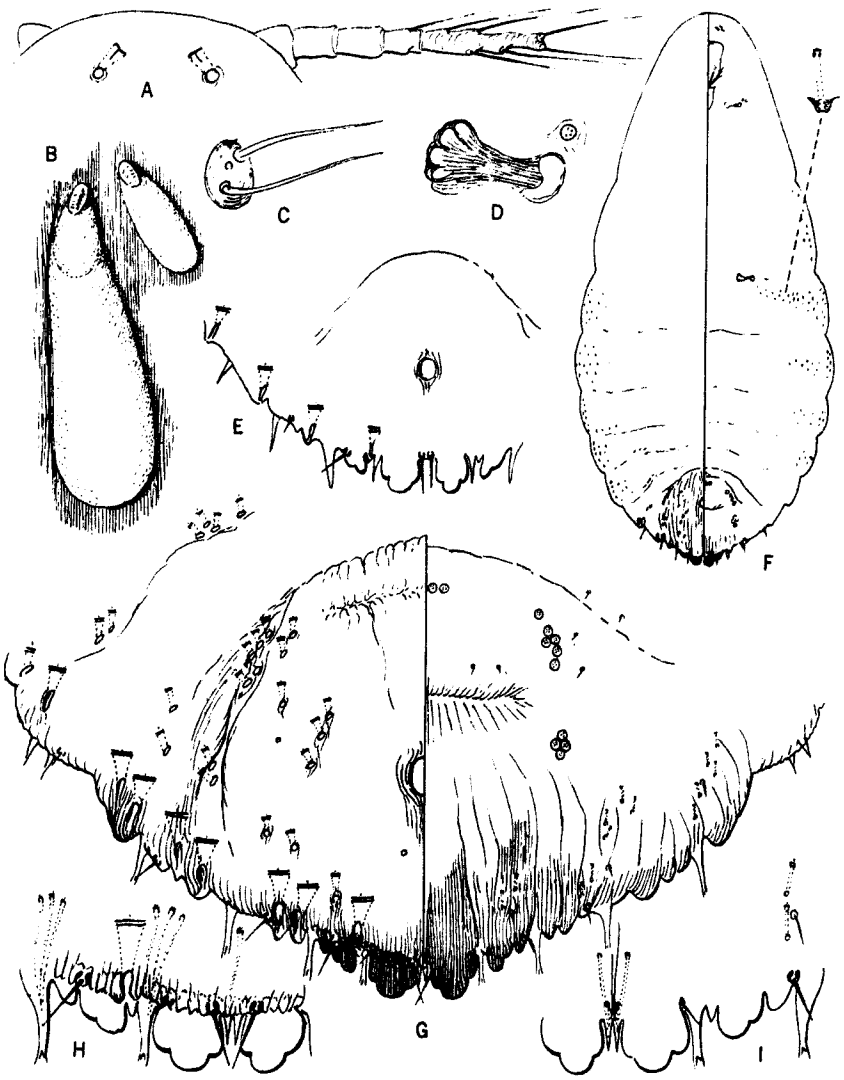

Fig. 54. *Aonidomytilus concolor* (Cockerell), concolor scale.

throughout California from the extreme northern to the southern end. A few of the locality records are here included, some of these representing nursery infestations.

Alameda Co.: Niles, XI-3-49 (W. S. Sibray).
Butte Co.: Chico, II-9-34 (M. L. Jones).
Fresno Co.: Fresno, IV-11-39 (T. B. Gallion).
Glenn Co.: Willows, IX-15-32 (C. H. Spurlock).
Kern Co.: Bakersfield, X-28-40 (T. B. Gallion).
Kings Co.: Hanford, X-9-41 (J. W. Dixon).
Los Angeles Co.: Hollywood, I-19-37 (Schlenz).
Orange Co.: Buena Park, III-21-35 (C. S. Morley). Costa Mesa, IV-8-42 (R. J. Bumgardner).
Placer Co.: Lincoln, III-1-40 (S. L. Lockwood).
Sacramento Co.: Folsom, IX-27-37 (W. Travioli). Sacramento, III-21-39 (O. Ohrt).
San Bernardino Co.: Needles, XI-6-41 (G. A. Pohl).
San Diego Co.: San Diego, II-20-35 (J. O. Brodeur).
San Joaquin Co.: Stockton, II-19-47 (J. W. Dixon).
San Mateo Co.: Redwood City, XI-4-43 (Gray and Hess).
Santa Clara Co.: San Jose, II-6-35 (D. B. Custer).
Santa Cruz Co.: Santa Cruz, IX-1931 (C. V. Dick).
Tehama Co.: Corning, II-26-35 (R. O. Brandt).
Tulare Co.: Tulare, IX-6-40 (F. G. Lackland).
Ventura Co.: Camarillo, VIII-8-39 (C. Gammon). Ventura, VI-20-40 (C. R. Tower).
Yuba Co.: Marysville, VII-30-43 (A. W. Worledge).

Carulaspis minima (Targioni)
Minute cypress scale
(Fig. 56*a*)

Diaspis minima Targioni, 1869, Cat. cocc. ital., p. 43.
Diaspis minima Targioni, Comstock, 1883, 2d. Rep. Dept. Ent. Cornell Univ., 2:96.
Diaspis minima Targioni, King, 1902, Canad. Ent., 34:61.
Carulaspis minima (Targioni), Balachowsky, 1954, Mem. Sci. L'Inst. Past., pp. 210-212, illus.
Type locality: Europe.
Type host: *Thuja* sp., arborvitae.
Relation to host: Adult female scale white or light gray, circular, exuviae approximately central; male scale elongate, white and only slightly carinated.
Additional hosts: *Callitris articulata, Cupressus* spp., *Juniperus* spp., and *Sequoia sempervirens.*
Discussion:

For years this species has not been recognized nor segregated from the Juniper scale, *Carulaspis visci* (Shrank). Balachowsky (1954) has very adequately described the *Carulaspis* species occurring in the Palearctic region, and his treatise includes the forms found in California.

Carulaspis minima is easily differentiated from *C. visci* by lack of a marginal pygidial macroduct between the median lobes, whereas this macroduct is present in the latter species. Comstock (1883) claims that *minima* is readily distinguished from *visci* by the form of the scale of the male, which is described as being without carinae. This character does not seem too reliable, and little emphasis is placed upon it.
California records:

Fresno Co.: Fresno, X-9-47 (J. W. Dixon).
Los Angeles Co.: Hawthorne, III-24-39 (M. R. Bell).
Monterey Co.: Carmel, VII-9-42 (M. R. Bell).
Orange Co.: Santa Ana, VI-4-32 (D. W. Tubbs).
Sacramento Co.: Sacramento, III-1-39 (J. B. Steinweden).
San Diego Co.: La Jolla, X-31-33 (R. R. McLean). National City, IX-28-55 (L. Haworth and D. Sprague). Ocean Beach, XI-25-55 (D. Sprague and J. Wilson). San Diego, III-17-36 (R. R. McLean).
Santa Barbara Co.: Santa Barbara, IX-29-47 (F. B. Treloor).
Solano Co.: Vallejo, XI-17-55 (L. A. Black and P. C. Martinelli).
Tulare Co.: Visalia, XII-15-47 (O. L. Hemphill).
Yuba Co.: Marysville, XI-6-42 (A. W. Worledge).

Carulaspis visci (Schrank)
Juniper scale
(Pl. 2, middle row, right; fig. 57)

Coccus visci Schrank, 1781. Enumeratio insectorum Austriae, pp. 296 and 588.
Aspidiotus juniperi Bouché, 1851. Stettin. ent. Ztg., 12:112.
Diaspis carueli Targioni, 1869. Catalogue, p. 43.
Carulaspis visci (Schrank), Ferris, 1937, Atlas of Scale Insects, Ser. I:12.
Type locality: Europe.
Type host: *Viscum album,* mistletoe.
Relation to host: Adult female scale white or whitish-green, circular, exuviae central; male scale elongate, white, and slightly tricarinate.
Additional hosts: *Chamaecyparis, Cryptomeria*

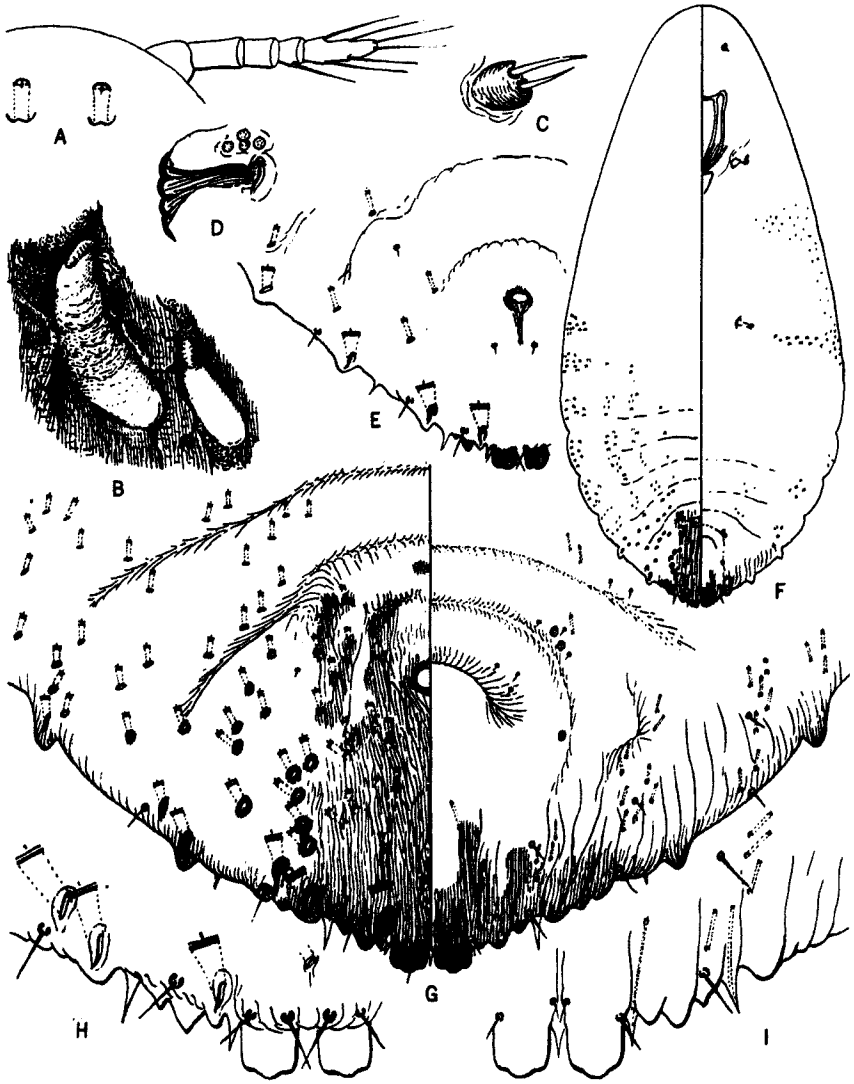

Fig. 55. *Aonidomytilus variabilis* Ferris, variable scale.

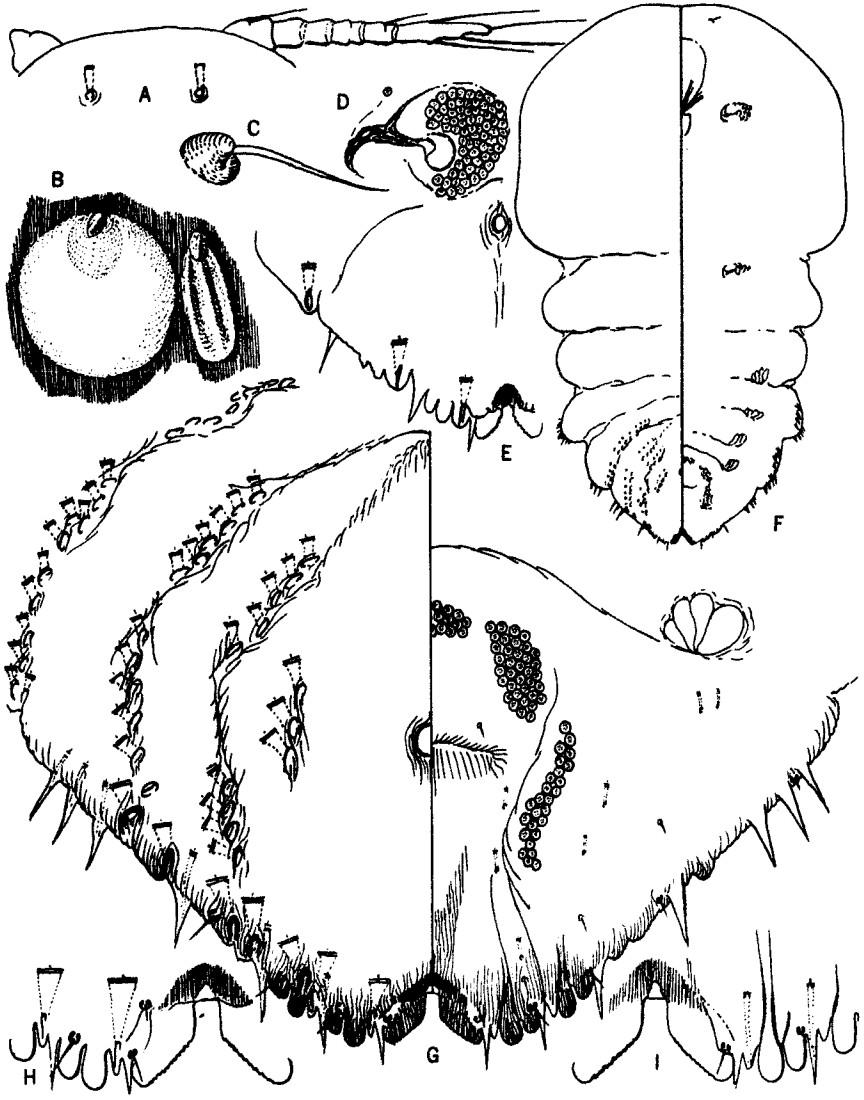

Fig. 56. *Aulacaspis rosae* (Bouché), rose scale.

japonica, Cupressus spp., *Juniperus virginiana, Juniperus* spp., *Libocedrus decurrens, Picea, Pinus filifolia, Sequoia gigantea, Sequoia sempervirens,* and *Thuja.*

Discussion:

This is a common species occurring quite generally throughout the entire United States. *Carulaspis visci* (Shrank) may be segregated from *C. minima* (Targioni) by the presence of a marginal macroduct between the median pygidial lobes, whereas this structure is absent in the later species.

California records:

This species is very generally distributed throughout California. Consequently, only a few specific localities from which it has been taken are here included. A few of these represent nursery infestations.

Alameda Co.: Hayward, V-2-38 (J. B. Steinweden and M. L. Jones).

Butte Co.: Chico, VI-20-41 (R. Swett).

Contra Costa Co.: Walnut Creek, XI-21-41 (M. R. Bell).

Fresno Co.: Fresno, IX-16-43 (G. Beevor).

Humboldt Co.: Eureka, XII-1931 (Peacock).

Kern Co.: Shafter, VII-14-41 (T. B. Gallion).

Los Angeles Co.: Los Angeles, VII-13-36 (V. E. Williams). South Pasadena, VII-31-33 (V. E. Williams).

Madera Co.: Madera, II-29-40 (J. W. Dixon).

Mendocino Co.: Ukiah, III-2-39 (J. B. Steinweden).

Merced Co.: Delhi, II-19-40 (C. H. Kinsley. Merced, VII-20-44 (C. H. Kinsley).

Orange Co.: La Habra, V-1-42 (K. D. Sloop).

Placer Co.: Auburn, II-19-42 (H. W. Marshall). New Castle, III-23-42 (H. W. Marshall).

San Bernardino Co.: San Bernardino, VIII-7-41 (C. R. Tower).

San Diego Co.: Oceanside, XI-18-40 (C. R. Tower).

San Francisco Co.: San Francisco, VII-26-41 (M. R. Bell).

Santa Cruz Co.: Santa Cruz, VII-24-41 (M. R. Bell).

Stanislaus Co.: Modesto, XI-3-41 (J. W. Dixon). Turlock, II-2-40 (A. Post).

Tulare Co.: Visalia, IV-1-39 (O. L. Hemphill).

Chionaspis americana Johnson
Elm scurfy scale
(Fig. 58)

Chionaspis americana Johnson, 1896, Ent. News, 7:150.

Fundaspis americana (Johnson), MacGillivray, 1921, The Coccidae, p. 338.

Chionaspis americana Johnson, Ferris, 1937, Atlas of Scale Insects, Ser. I:15.

Type locality: Illinois.

Type host: *Ulmus americana,* American elm.

Relation to host: Occurring on the bark of its host. Adult female scale white, elongate, exuviae at one end; male scale similar in color to that of adult female, elongate but much smaller.

Additional hosts: Ferris (1937) lists *Celtis* as an additional host of this scale insect, and the State Department of Agriculture records show mulberry (*Morus* sp.) as an added species.

Discussion:

The median pygidial lobes being closely appressed throughout their entire length, their mesal margins straight and their outer margins twice notched, serve as diagnostic characters in distinguishing this species from other California *Chionaspis.*

This scale is reported as capable of damaging young elm trees. It has, apparently, persisted in California for many years without becoming too aggressive. A recent nursery infestation was detected after a few elm trees had been sold to retail trade with no record of purchaser. The remainder of the infested elms were treated to prevent further spread throughout the state.

California records:

Los Angeles Co.: Beverly Hills, VII-25-33 (V. E. Williams). Los Angeles, VIII-4-36, (V. E. Williams). San Gabriel, VII-11-39.

Orange Co.: Santa Ana, IX-28-54 (R. A. Mackessy and J. B. Walden).

San Diego Co.; National City, IX-28-55 (D. Sprague and L. Haworth).

Chionaspis corni Cooley
Dogwood scale
(Fig. 59)

Chionaspis corni Cooley, 1899, Mass. Expt. Sta. Spec. Bull., p. 15.

Chionaspis corni Cooley, Ferris, 1937, Atlas of Scale Insects, Ser. I:16.

Type locality: Reading, Massachusetts.

Type host: *Cornus paniculata,* dogwood.

Relation to host: Occurring on the bark of the host. Adult female scale white, elongate, exuviae at one end; male scale of the same color and shape as that of the adult female, only smaller, exuvia at one end.

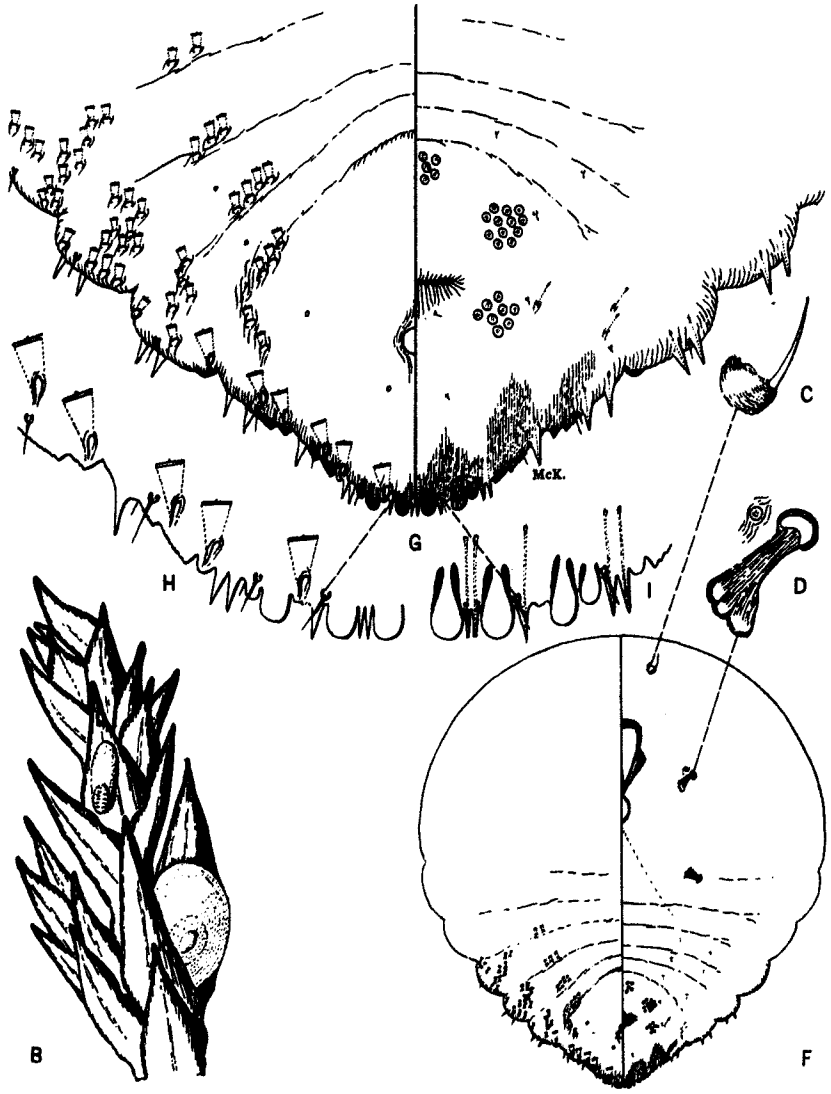

Fig. 56a. *Carulaspis minima* (Targioni), minute cypress scale.

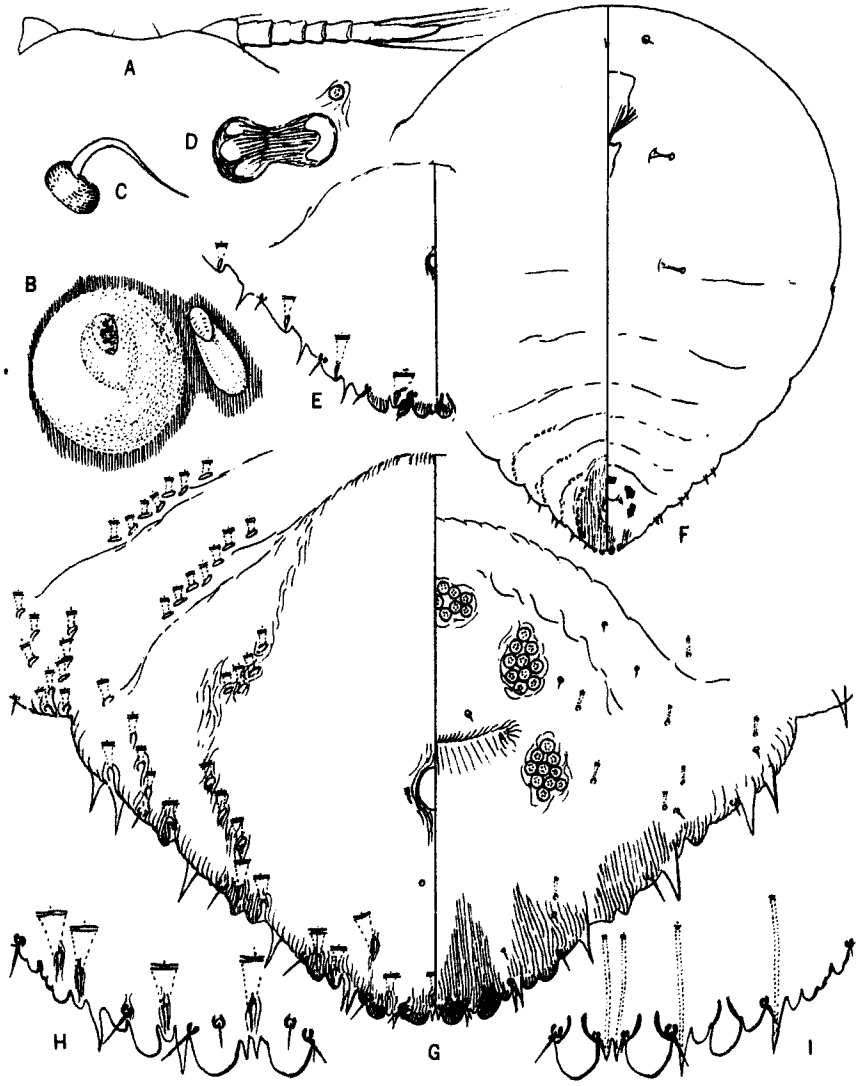

Fig. 57. *Carulaspis visci* (Schrank), juniper scale.

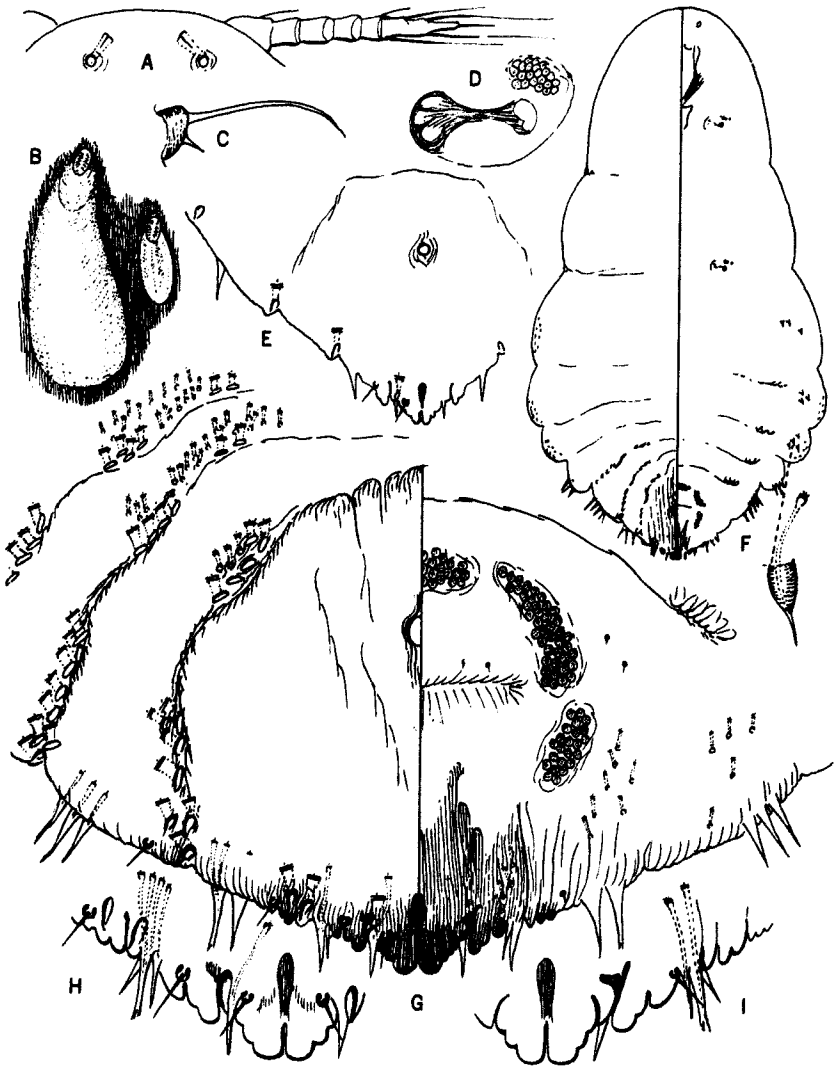

Fig. 58. *Chionaspis americana* Johnson, elm scurfy scale.

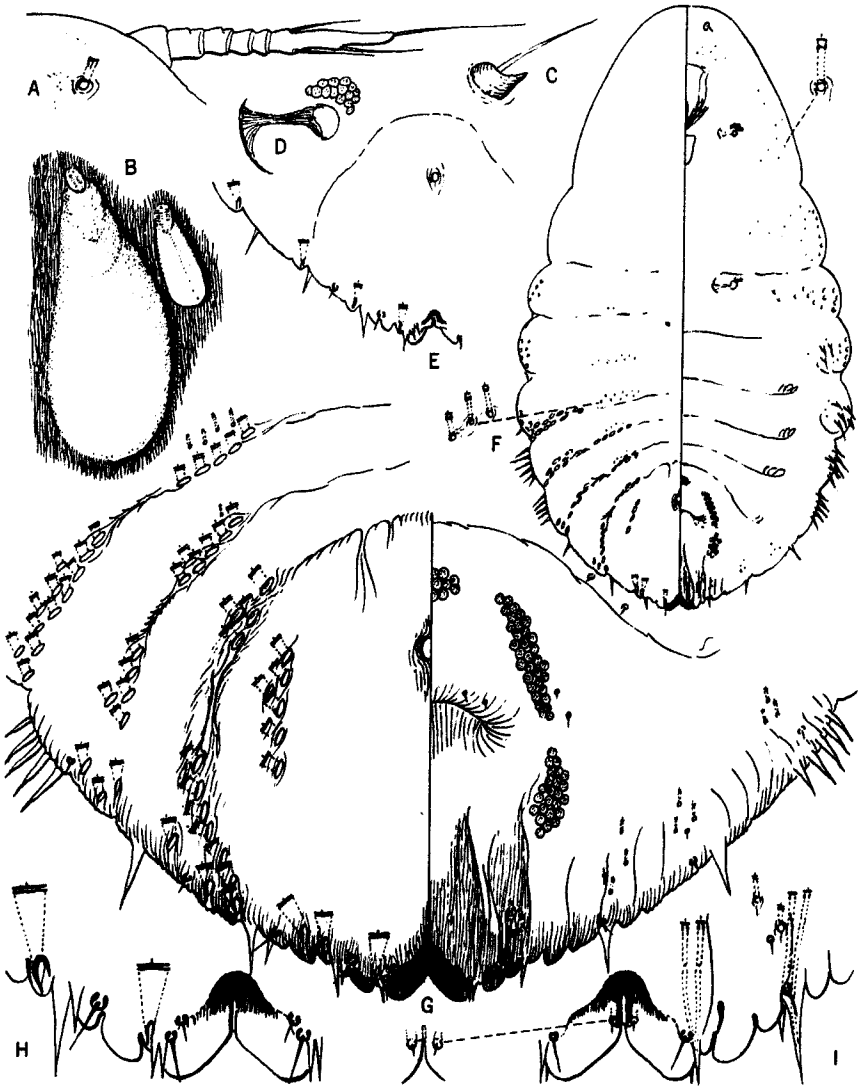

Fig. 59. *Chionaspis corni* Cooley, dogwood scale.

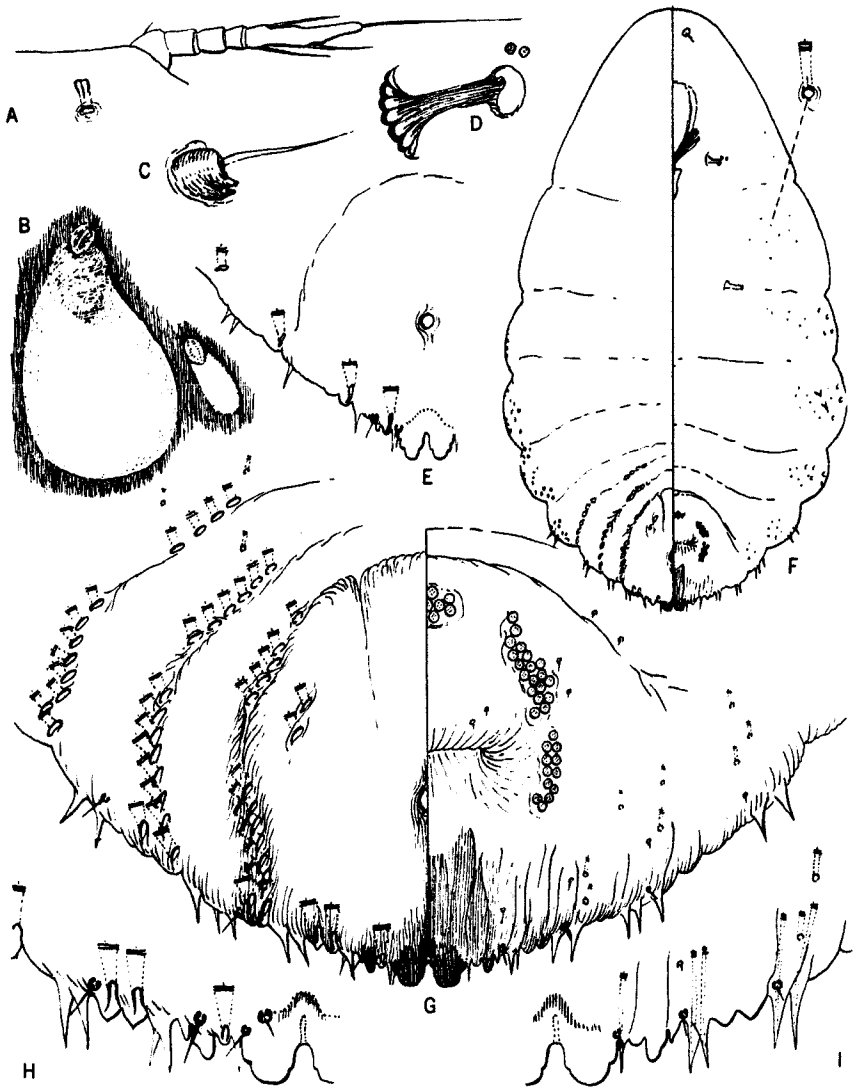

Fig. 60. *Chionaspis etrusca* Leonardi, tamarix scale.

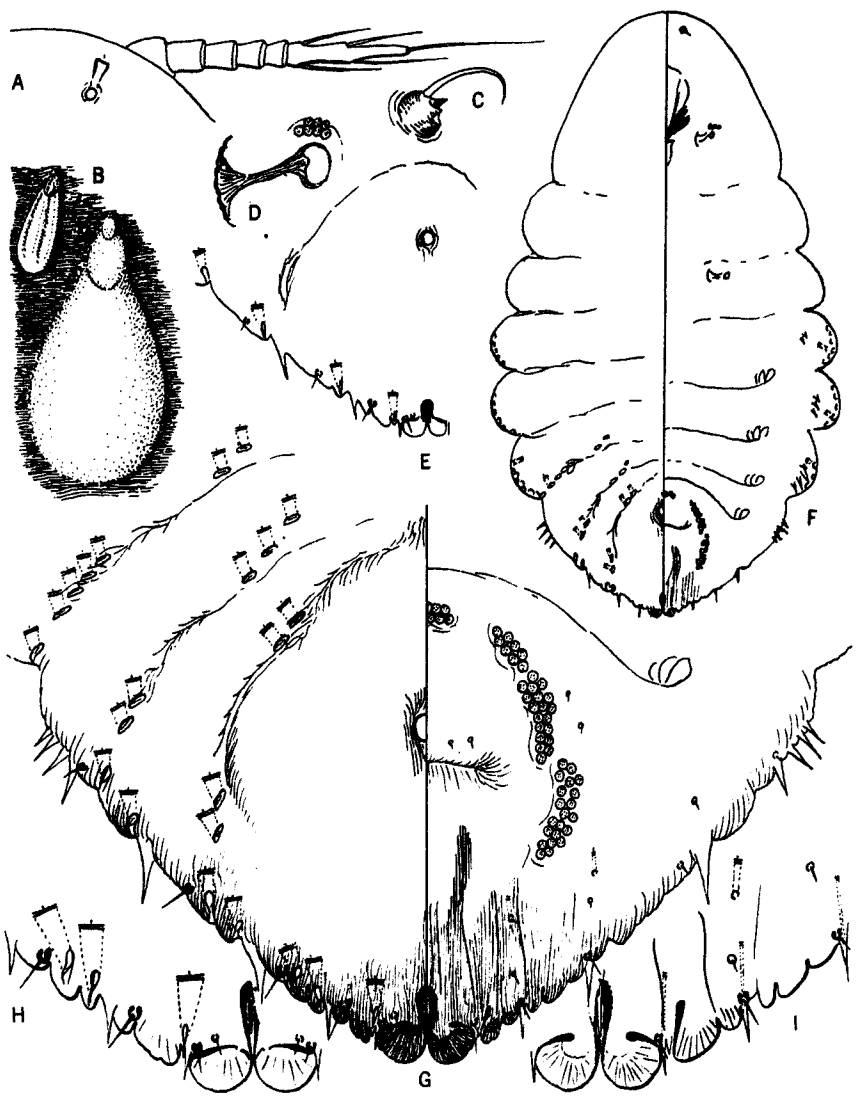

Fig. 61. *Chionaspis furfura* (Fitch), scurfy scale.

Additional host: In addition to *Cornus*, the species is represented in the State Department collection on *Ribes* sp.

Discussion:

The most distinctive feature of this species is the character of the median pygidial lobes which have their mesal margins straight, and are broadly divergent and somewhat longer than the free outer margin. These characters, plus the fact that the species generally occurs on *Cornus*, readily distinguishes this species from other California *Chionaspis*.

California records:

Butte Co.: Paradise, VII-30-39 (H. H. Keifer).

Los Angeles Co.: Quincy, VII-5-34 (L. E. Myers).

Madera Co.: Bass Lake, VII-13-42 (J. Wilson).

Placer Co.: Pilot's Hill, VI-12-38 (J. B. Steinweden).

Santa Clara Co.: Mountain View, 1900 (S. I. Kuwana).

Shasta Co.: Castle Crag, V-14-52 (R. P. Allen).

Chionaspis etrusca Leonardi
Tamarix scale
(Fig. 60)

Chionaspis etrusca Leonardi, 1908, Ann. Agric., 8:44.

Chionaspis sassceri Cockerell and Robbins, 1909, Jour N.Y. Ent. Soc., 17(3):105, illus. (misidentification).

Chionaspis etrusca Leonardi, Ferris, 1937, Atlas of Scale Insects, Ser. I:17.

Type locality: Europe.

Type host: *Tamarix* sp.

Relation to host: Occurring on the bark. Adult female scale white, elongate and unusually broad, exuviae near one end; male scale smaller, white, elongate, exuvia at one end.

Additional hosts: Recorded only from *Tamarix*.

Discussion:

Chionaspis etrusca Leonardi approaches *C. ortholobis* Comstock, but differs from it chiefly in the lateral notching of the well-separated median pygidial lobes. The median lobes of *C. ortholobis* are set closely together, smoothly rounded, and without notches.

California records:

Glenn Co.: Willows, III-31-55 (C. Cordill and C. Lowlard).

Imperial Co.: Calexico, XII-20-48 (A. J. Hansen and C. G. Anderson).

Kern Co.: Bakersfield, VII-27-50 (C. S. Morley). McFarland, VII-13-48 (J. J. Kalstrom).

Los Angeles Co.: Tarzana, IV-14-41.

Riverside Co.: Banning, VIII-28-23. (C. R. Tower). Coachella, IV-26-23. Riverside, VII-13-44 (C. Z. Yonge).

San Bernardino Co.: Barstow, II-22-43 (C. J. Hayward). Colton, V-5-50 (G. Harper). Needles, XI-4-41 (G. Pohl and A. Breech). Trona, VII-17-40 (J. P. Coy).

San Diego Co.: Borrego Valley, VI-20-52 (L. Hayworth).

Stanislaus Co.: Modesto, IV-22-40 (H. E. Wallace).

Tulare Co.: Tulare, I-22-41 (O. A. Hemphill).

Chionaspis furfura (Fitch)
Scurfy scale
(Fig. 61)

Aspidiotus furfurus Fitch, 1856. Trans. N.Y. State Agric. Soc. 16:352.

Aspidiotus cerasi Fitch, 1856. Trans. N.Y. State Agric. Soc. 16:368.

Aspidiotus Harrisii (Walsh), 1867. Practical Entomologist, p. 119.

Chionaspis furfurus variety *fulvus* King, 1899, Psyche, 8:334.

Chionaspis furfura (Fitch), Ferris, 1937, Atlas of Scale Insects, Ser. I:18.

Type locality: New York, New York.

Type host: *Pyrus communis*, pear.

Relation to host: Occurring on the bark of host. Adult female scale white, elongate, exuviae at one end; male scale white, narrow and elongate, and somewhat carinate.

Additional hosts: According to Ferris (1937) the host list is long, but the species seems to occur especially on rosaceous trees such as *Crataegus, Cydonia oblonga, Malus pumila, Prunus* spp. (cherry), and *Pyrus communis*. California State Department of Agriculture records indicate this species as infesting *Betula* and *Cotoneaster*.

Discussion:

This is the so-called "scurfy scale" of economic entomologists. To date it has been found only in California nurseries, although it is suspected that owing to the sale of certain movable nursery plants the species may be established at other points in California.

It is especially marked by the shape of the median pygidial lobes. These lobes are set close together, are low, and apically rounded giving a suggestion of being turned back to back. The median yoke is elongate and conspicuously

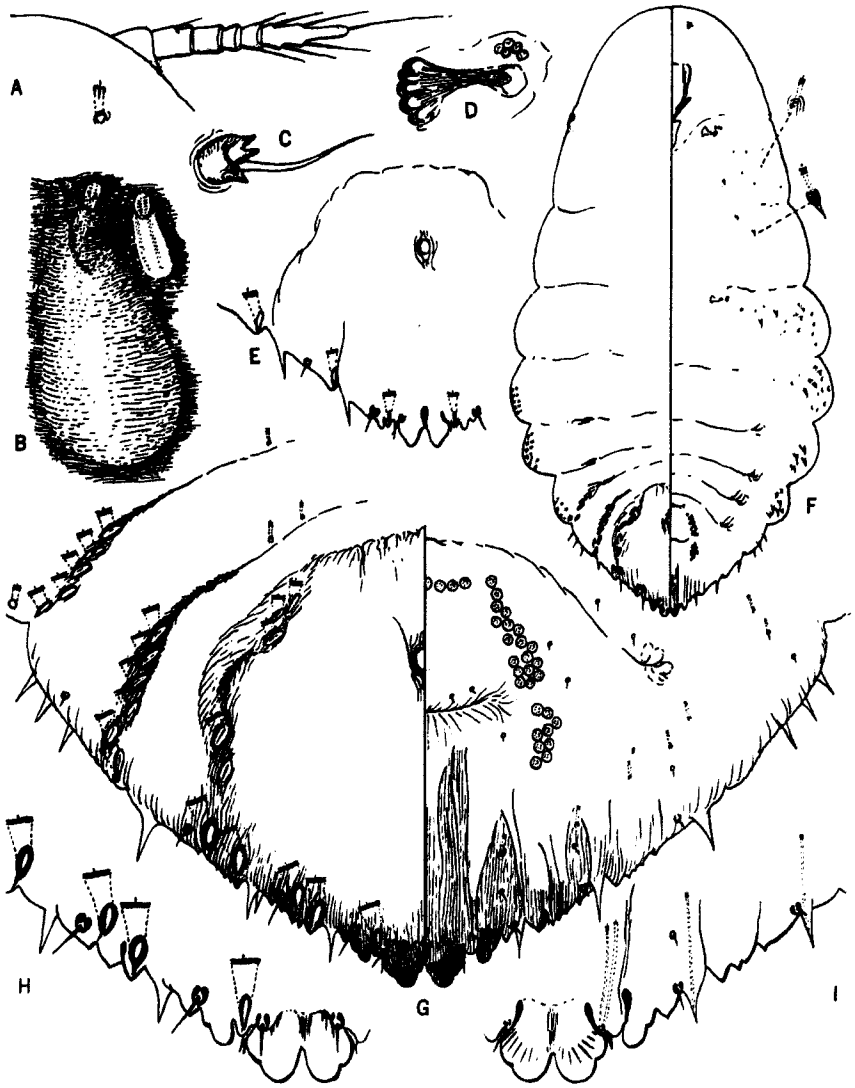

Fig. 62. *Chionaspis gleditsiae* Sanders, honey locust scale.

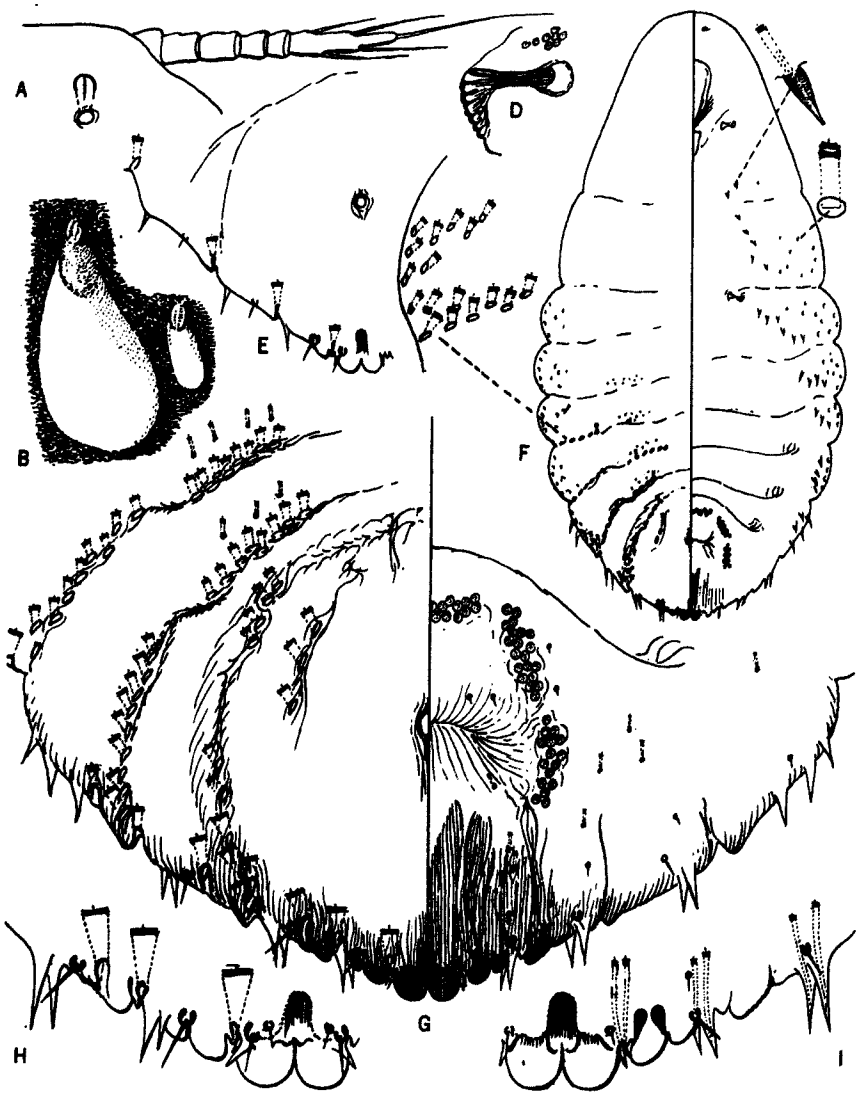

Fig. 63. *Chionaspis ortholobis* Comstock, cottonwood scale.

sclerotic, and each median lobe has a basal transverse, sclerotic bar.

California records:

Fresno Co.: Fresno, IV-13-39 (J. W. Dixon).

San Diego Co.: San Diego, XII-17-53 (G. W. Schwegel).

Chionaspis gleditsiae Sanders
Honey locust scale
(Fig. 62)

Chionaspis gleditsiae Sanders, 1902, Ohio Nat., 3:413.

Chionaspis gleditsiae Sanders, Dietz and Morrison, 1916, Coccidae or Scale Insects of Indiana, p. 271, illus.

Chionaspis gleditsiae Sanders, Ferris, 1937, Atlas of Scale Insects, Ser. I:19.

Type locality: Columbus, Ohio.

Type host: *Gleditsia triacanthos*, honey or sweet locust.

Relation to host: Occurring on the bark, adult female scale grayish to white, elongate, broader at posterior end, exuviae near one end; male scale smaller, white, elongate, carinated, exuvia at one end. The scales oftentimes tend to be covered with the host epidermis and to be gray and inconspicuous.

Additional hosts: Recorded only from *Gleditsia triacanthos*.

Discussion:

The identification of this species rests upon the degree of fusion and nature of yoking of the median pygidial lobes, combined with the distribution and arrangement of the dorsal pygidial ducts. The species shows a very slight degree of median pygidial lobe yoking as compared to other California *Chionaspis*.

According to L. E. Myers, Entomologist, Los Angeles County Agriculture Commissioners Office, there was just one small infested locust tree in a 5-gallon can which had been in a nursery for several years before sold to the present owner. Immediately after discovery on December 1, 1954, the tree was destroyed. It is suspected, however, that other such trees may have been sold to retail trade with no record of sales and, as a result, the scale may be established elsewhere.

California records:

Los Angeles Co.: Los Angeles, XII-1-54 (K. C. Stephens).

Chionaspis orthobolis Comstock
Cottonwood scale
(Fig. 63)

Chionaspis orthobolis Comstock, 1881, Rep. U.S.-D.A. for 1880, p. 317, illus.

Chionaspis salicis-nigrae (Walsh), 1868. First Report on Noxious and Beneficial Insects of Illinois, p. 40 (misidentification).

Chionaspis orthobolis Comstock, Ferris, 1937, Atlas of Scale Insects, Ser. I:22.

Type locality: San Bernardino, San Bernardino County, California.

Type host: *Salix* sp., willow.

Relation to host: Occurring on the bark of the host. Adult female scale white, elongate with exuviae at one end; male scale white, narrow, and elongate, and noncarinate.

Additional hosts: In addition to *Salix*, Ferris (1937) records *Alnus, Arctostaphylos patula, Ceanothus* spp., and *Rhamnus purshiana*. The species is represented in the State Department of Agriculture collection on *Fremontia californica*.

Discussion:

Ferris (1937) indicates that certain specimens taken on *Ceanothus* in central and northern California exhibit slight morphological differences from typical *orthobolis*, but that this evidence is not sufficient to justify a separation. The species is very closely related to *Chionaspis sassceri* Cockerell and Robbins.

California records:

El Dorado Co.: Fallen Leaf Lake, VIII-1-44 (H. H. Keifer). Meeks Bay, VII-25-48 (H. T. Osborn). Phillips, VIII-1-44 (H. H. Keifer).

Inyo Co.: Bishop, X-12-52 (A. M. Boyce). Carroll Creek, 1936 (G. F. Ferris).

Kern Co.: Kernville, XII-10-38 (L. E. Myers).

Los Angeles Co.: Llano, VIII-8-46 (R. K. Bishop). North Hollywood, XII-8-39. Otterbein, I-17-39.

Madera Co.: North Fork, 1928 (G. R. Struble).

Orange Co.: Capistrano, I-16-39 (C. E. Norland). Orange, XII-8-43 (L. R. Gillogly). Santa Ana, IV-14-43 (J. B. Walden).

Riverside Co.: San Jacinto Mountains, X-6-39 (F. R. Platt).

San Bernardino Co.: Big Bear Lake, IX-6-33 (L. E. Myers). Cedar Pine Park, VI-28-33 (M. S. Walsh). San Bernardino, 1936 (H. L. McKenzie).

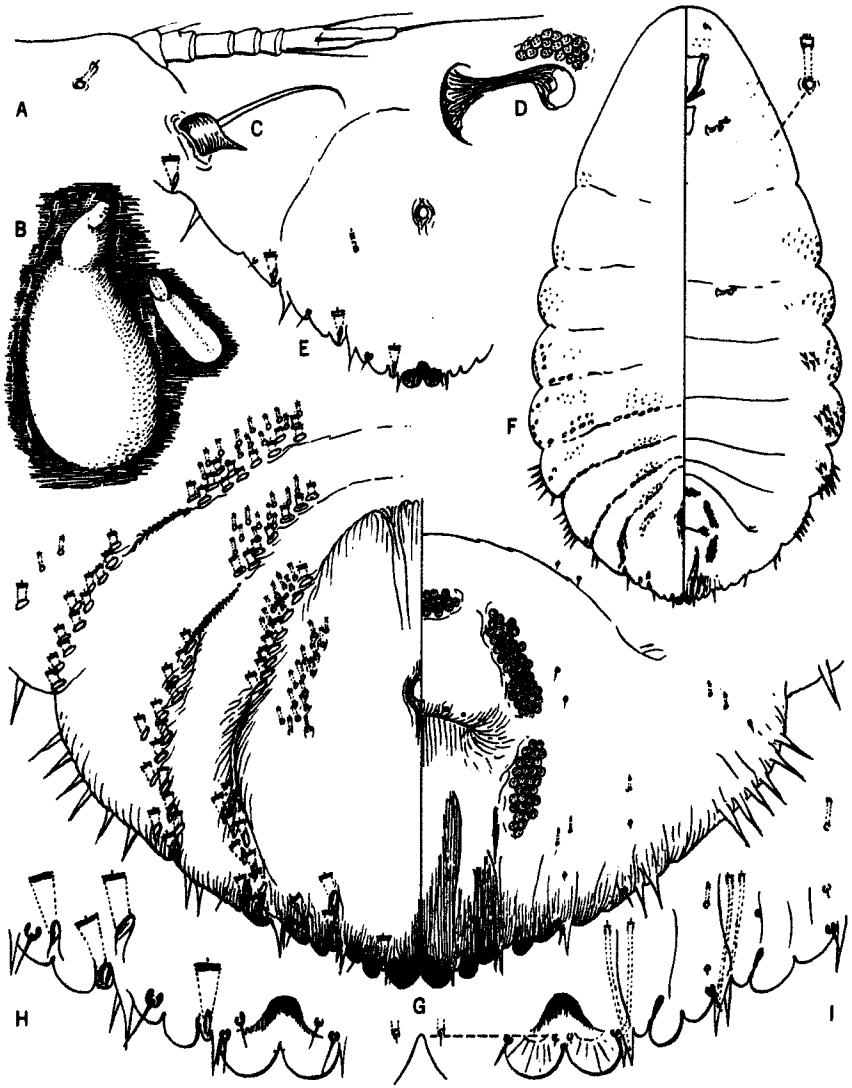

Fig. 64. *Chionaspis salicis-nigrae* (Walsh), black willow scale.

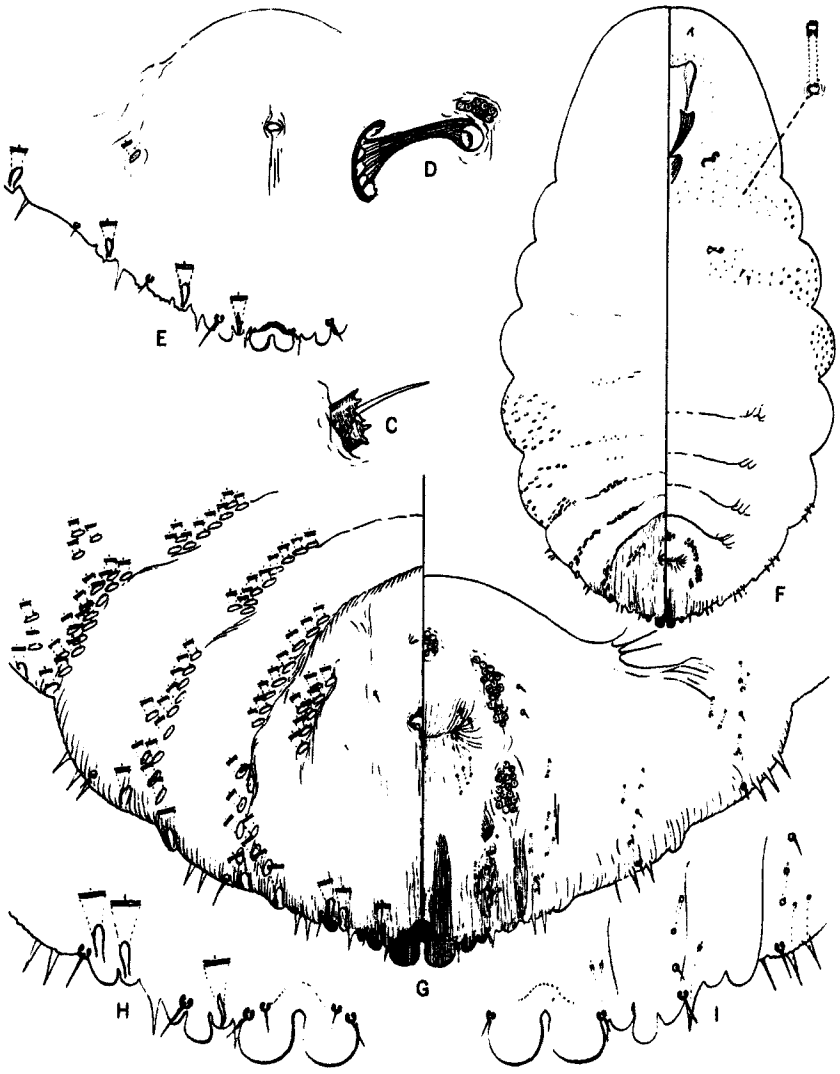

Fig. 65. *Chionaspis sassceri* Cockerell and Robbins, Sasscer scale.

San Diego Co.: Flinn Springs, X-2-41 (A. W. Lewis). Jamacha, V-7-53 (R. M. Hawthorne and R. J. Buckner). San Diego, III-27-40, (J. W. Dixon). San Ysidro, I-25-43 (C. Gammon).

Tuolumne Co.: Groveland, VII-6-44 (C. E. Gustafson).

Ventura Co.: Montalvo, II-16-48 (T. L. Nasalroad). Ventura, II-23-38 (E. L. Smith).

Chionaspis salicis-nigrae (Walsh)
Black willow scale
(Pl. 3, top row, left; fig. 64)

Aspidiotus salicis-nigrae Walsh, 1868. First Report on Noxious and Beneficial Insects of Illinois, p. 40.

Mytilaspis salicis Le Baron, 1871, Trans. Iowa Hort. Soc., p. 140 (preoccupied).

Chionaspis salicis (Linnaeus), 1881, Rep. U.S.-D.A. for 1880, p. 320 (misidentification).

Chionaspis orthobolis Bruneri Cockerell, 1898, Canad. Ent., 30:133.

Chionaspis salicis-nigrae (Walsh), Ferris, 1937, Atlas of Scale Insects, Ser. I:24.

Type locality: Illinois.

Type host: *Salix nigra,* black willow.

Relation to hosts: Occurring on the bark of the host species. Adult female scale snow white, quite thick and heavy, exuviae at one end; male scale white, elongate, and with an indistinct median carina.

Additional hosts: In addition to *Salix* the species has been reported on *Amelanchier, Cornus, Liriodendron,* and *Populus* spp.

Discussion:

According to Ferris (1937) the types of this species are known to have been destroyed, and the recognition of it rests upon the work of Cooley. The species is characterized chiefly by the submedian dorsal duct groups of segments three and five, with about one-half or more of the ducts very small, and submedian group of segment six at times composed entirely of small ducts.

California records:

Lassen Co.: Susanville, V-18-31 (F. H. Taylor). Modoc Co.: Alturas, VIII-6-36 (H. Hunt).

Ventura Co.: El Rio, IV-25-36 (E. L. Smith). Montalvo, II-8-35 (E. L. Smith). Saticoy, V-1-36. (E. L. Smith). Ventura, VIII-14-33.

Chionaspis sassceri Cockerell and Robbins
Sasscer scale
(Fig. 65)

Chionaspis sassceri Cockerell and Robbins, 1909. Jour. N.Y. Ent. Soc., 17(3):105, illus.

Chionaspis sassceri Cockerell and Robbins, Ferris, 1942, Atlas of Scale Insects, Ser. IV:387.

According to Ferris (1942) "at least one published reference under the name *Chionaspis etrusca* Leonardi exists, this being based upon erroneous conclusions."

Type locality: Fallbrook, San Diego County, California.

Type host: Described from orange.

Relation to host: Described as occurring on the twigs. Adult female scale elongate, gray, smooth, exuviae at one end; male scale white, narrow, and elongated.

Additional hosts: In addition to orange the only other recorded host is *Ceanothus.*

Discussion:

According to Ferris (1942) "this species is exceedingly close to *Chionaspis ortholobis* Comstock, so much so that the writer is not entirely convinced that the two are really distinct." In *sassceri* the median lobes of the pygidium are noticeably rounded and are separated from each other to their bases, and the sclerotic zygosis of the median lobes is short. *Chionaspis ortholobis,* on the other hand, has the median lobes contiguous for part of their length, and the basal zygosis is narrow and elongate.

California records:

Riverside Co.: Idyllwild, VI-1936 (D. W. Clancy). San Diego Co.: Fallbrook (F. Austin).

Chionaspis wistariae Cooley
Wistaria scale
(Fig. 66)

Chionaspis wistariae Cooley, 1897. Canad. Ent., 29:280.

Chionaspis wistariae Cooley, Ferris, 1942. Atlas of Scale Insects, Ser. IV:388.

Type locality: Originally described from specimens from Japan taken in quarantine at San Francisco, California.

Type host: *Wistaria.*

Relation to host: Occurring mainly on the bark. According to Takahashi (in correspondence) the leaf-infesting species, here treated as *Phenacaspis fujicola* Kuwana, is considered a dimorphic form of *Chionaspis wistariae* Cooley. I believe it advisable to treat the species independently until positive indications of synonomy are based on critically controlled transfer experiments.

Scale of the female white, elongate, with exuviae at one end; male scale white, smaller, elongate and narrow, and quite definitely tricarinate.

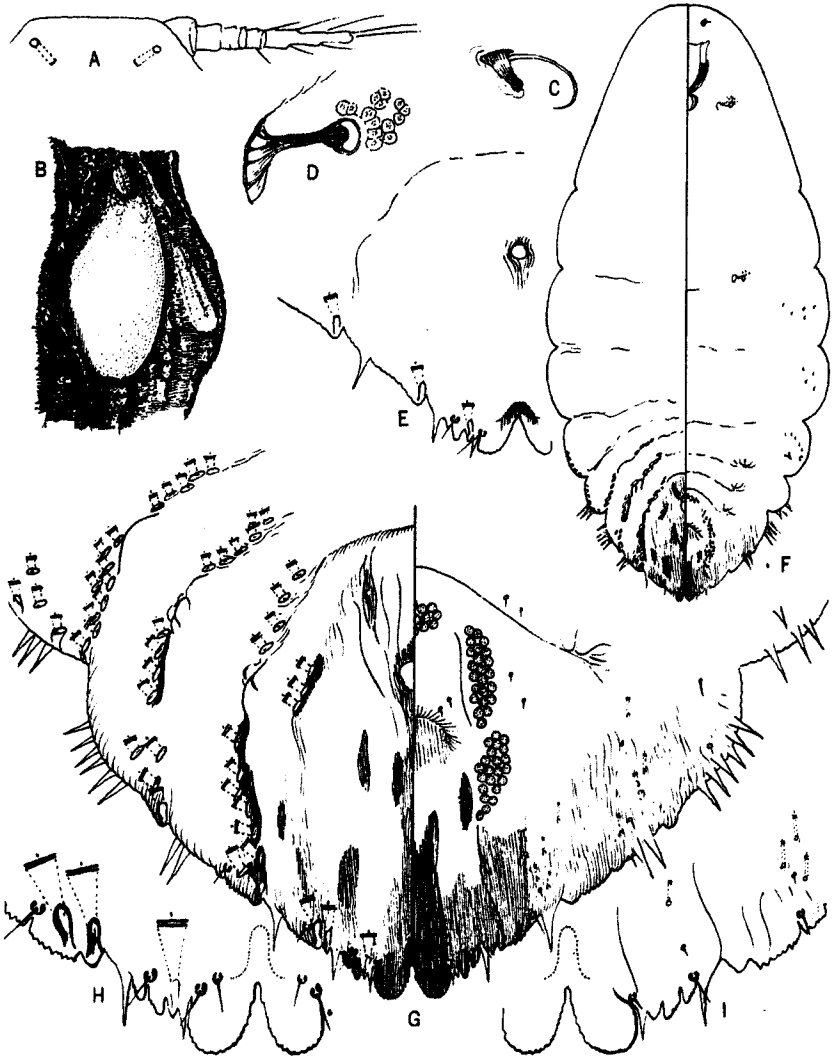

Fig. 66. *Chionaspis wistariae* Cooley, wistaria scale.

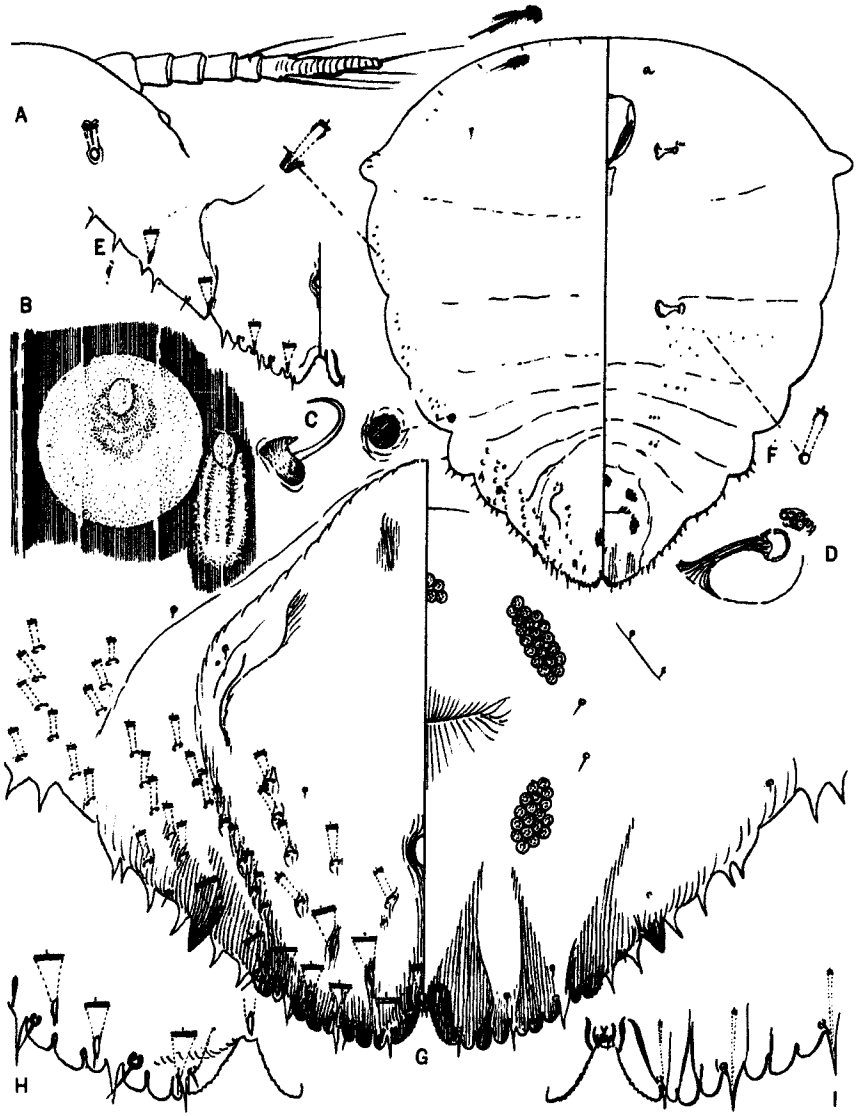

Fig. 67. *Diaspis boisduvalii* Signoret, Boisduval scale.

Additional hosts: *Alnus* and *Salix* are recorded hosts in addition to *Wistaria.*

Discussion:

The character of the finely dentate median pygidial lobes, the narrow, elongate zygosis of these lobes, and the narrow and acute second pygidial lobes distinguishes this species from other California *Chionaspis.*

Chionaspis wistariae Cooley was recently (1955) transferred to genus *Phenacaspis* Cockerell and Cooley by Ferris (Microentomology, 20(3):53-54, illus.). According to Ferris the transfer was made because the basal zygosis of the median lobes was not developed enough to bring about a contiguity of the lobes themselves—a character which apparently defines *Chionaspis.* However, the *degree* of development of this zygosis in *wistariae* would, in my opinion, still justify its retention in *Chionaspis.*

The leaf-infesting species on *Wistaria* in California is here considered to be *Phenacaspis fujicola* Kuwana. Takahashi (in correspondence) believes this species to be a dimorphic form of *Chionaspis wistariae* Cooley, although I am inclined to leave the status of these two species unchanged until experimental crossbreeding has proven otherwise.

California records:

Alameda Co.: Treasure Island, X-3-40 (G. B. Laing).

Los Angeles Co.: Compton, VI-17-36 (V. E. Williams). Glendale, VIII-29-38. Inglewood, VIII-27-26 (L. E. Myers). Los Angeles, X-18-35 (V. E. Williams). Maywood, IX-9-35 (V. E. Williams). Pasadena, III-5-40. San Pedro, IX-23-35 (V. E. Williams).

San Diego Co.: San Diego, X-27-54 (K. H. Baker).

Diaspis boisduvalii Signoret
Boisduval scale
(Fig. 67)

Diaspis boisduvalii Signoret, 1869, Ann. Soc. ent. Fr., 4(9):432.

Aulacaspis boisduvalii (Signoret), Cockerell, 1893, Gdnrs' Chron., 3(8):548.

Aulacaspis cattleyae (Cockerell), 1899, Biol. cent-amer., 2(2):30.

Diaspis cattleyae (Cockerell), 1902. Entomologist, 35:59.

Diaspis boisduvalii Signoret, Ferris, 1937. Atlas of Scale Insects, Ser. I:32.

Type locality: Luxembourg, Germany.

Type host: Orchid (under glass).

Relation to host: Primarily a leaf-infesting species. Adult female scale white, transparent, quite thin, flat, circular, exuviae subcentral; male scale white, elongate, tricarinate.

Additional hosts: This scale is principally a greenhouse pest. *Cattleya* and *Cymbidium* orchids appear to be the most common hosts, although other orchids, palms, cactus, *Maranta,* and certain tropical plants may be attacked.

Discussion:

This species is characterized chiefly by the presence of lateral lobes on the prosoma. However, an examination of a considerable series of specimens indicates this character is evidently variable, since some examples have a lobe on one side of the body and not on the other, whereas others of the same series may have no prosomal lobes at all. The companion species, *Diaspis cocois* Lichtenstein, is discussed in this bulletin. It shows no trace of lateral lobes on prosoma. There may be only one species involved in this complex, although further investigations are needed to prove this.

California records:

This species is common in greenhouses throughout California. A few specific localities are listed below:

Alameda Co.: Berkeley, XI-24-37 (D. B. Mackie). San Leandro, I-21-44 (M. R. Bell).

Fresno Co.: Fresno, XII-20-44 (J. W. Dixon).

Los Angeles Co.: Los Angeles, XI-17-41 (D. B. Mackie).

Marin Co.: Larkspur, XII-28-43 (M. R. Bell).

Monterey Co.: Del Monte, X-24-33 (F. J. March).

Orange Co.: Santa Ana, VI-12-41 (C. R. Tower).

Riverside Co.: Palm Springs, II-1947.

Sacramento Co.: Sacramento, II-21-41 (J. B. Steinweden).

San Bernardino Co.: Chino, VII-10-42 (C. R. Tower).

San Diego Co.: San Diego, IV-3-30 (R. R. McLean).

San Francisco Co.: San Francisco, VIII-29-38 (F. J. March).

San Mateo Co.: Redwood City, IV-28-42 (M. R. Bell).

Santa Barbara Co.: Santa Barbara, VI-23-35 (G. E. Woodhams).

Ventura Co.: Oxnard, VIII-3-39 (C. Gammon).

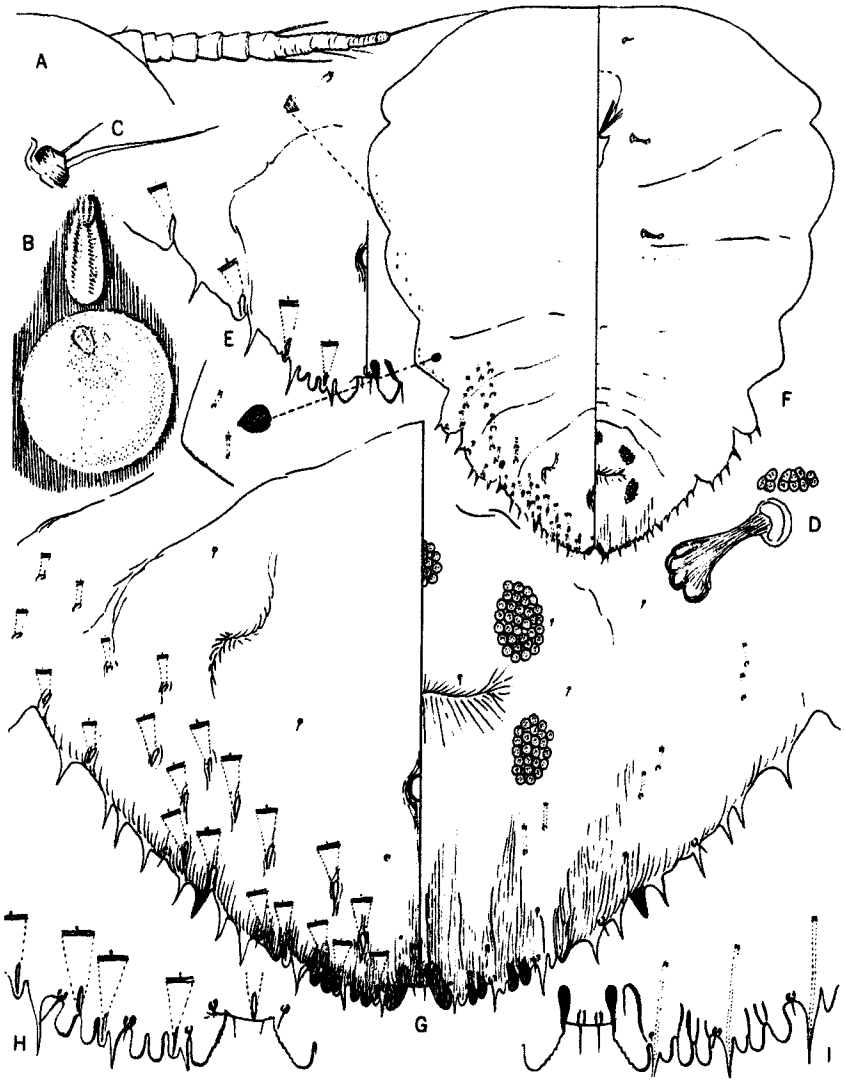

Fig. 68. *Diaspis bromeliae* (Kerner), pineapple scale.

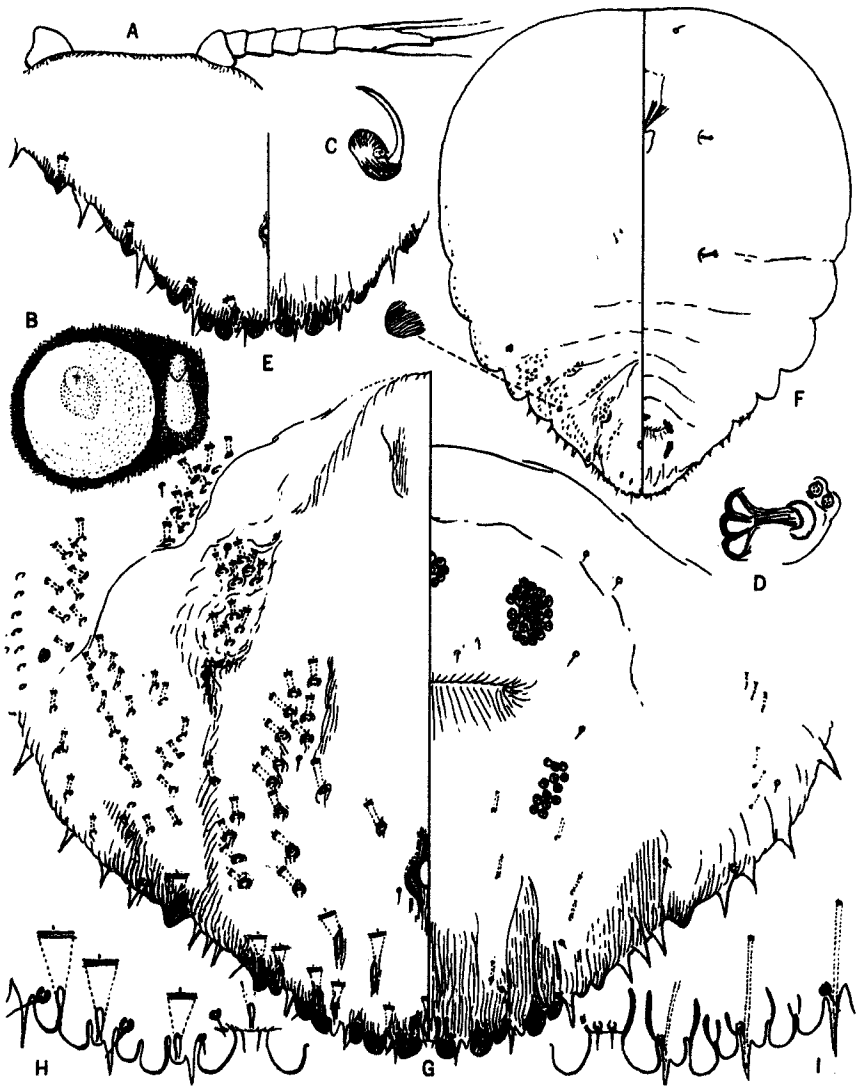

Fig. 69. *Diaspis echinocacti* (Bouché), cactus scale.

Diaspis bromeliae (Kerner)
Pineapple scale
(Pl. 2, bottom row, center; fig. 68)

Coccus bromeliae Kerner, 1778. Naturgeschichte des Inseckten, pp. 20 and 52.
Chermes bromeliae (Kerner), Boisduval, 1867. Entomologie Horticole, p. 334.
Aulacaspis bromeliae (Kerner), Cockerell, 1894, Canad. Ent., 26:33.
Diaspis bromeliae (Kerner), Ferris, 1937, Atlas of Scale Insects, Ser. I:33.
Type locality: Europe (in hot houses).
Type host: *Ananas comosus (=sativus)*, pineapple.
Relation to host: A leaf-infesting species. Adult female scale white, rather thin, flat, circular, the exuviae subcentral; male scale white, elongate, and tricarinate.
Additional hosts: The most common host is pineapple, *Ananas comosus.* Other hosts include *Anthericum, Billbergia, Bromelia pingiun,* and a number of other plants; some records of which are very possibly erroneous.
Discussion:

This species is readily differentiated from other California *Diaspis* by the few and large dorsal ducts of the pygidium.

California records:

Los Angeles Co.: Compton, VI-16-36 (V. E. Williams). Long Beach, X-9-41. Montebello, VII-20-36 (V. E. Williams). North Hollywood, VII-16-36 (V. E. Williams). West Los Angeles, VI-2-36, (V. E. Williams).

Madera Co.: Madera, II-29-42 (T. B. Gallion).

Orange Co.: Santa Ana, III-19-41 (H. Mitchell).

San Bernardino Co.: Colton, XI-3-55 (W. Burr).

San Diego Co.: Leucadia, X-19-39 (R. R. McLean). San Diego, IX-19-40 (C. R. Tower).

San Francisco Co.: San Francisco, XI-1-32 (F. J. March).

Santa Barbara Co.: Santa Barbara, VII-27-43 (C. E. Ehmann and R. P. Allen).

Santa Clara Co.: Saratoga, III-23-54 (L. R. Cody).

Ventura Co.: Ventura, XI-20-39 (R. Young).

Diaspis cocois Lichtenstein
Cocos scale
(See fig. 67 for comparison)

Diaspis coccois Lichtenstein, 1882, Bull. Soc. ent. Fr., 6(2):36.
Diaspis tentaculatus Morgan, 1893, Ent. Mon. Mag., 29:41.
Aulacaspis coccois (Lichtenstein), Cockerell, 1899, Proc. Acad. Nat. Sci., Phila., p. 273.
Diaspis boisduvalii coccois Lichtenstein, Fernald, 1903, Catalogue of Coccidae, p. 228.
Diaspis cocois Lichtenstein, Ferris, 1937, Atlas of Scale Insects, Ser. I:32.
Type locality: France.
Type host: *Cocos nucifera,* coconut palm.
Relation to host: A leaf-infesting species. Adult female scale white, transparent, quite thin, flat, circular, exuviae subcentral; male scale white, elongate, tricarinate.
Additional hosts: *Chamaerops humilis, Cocos* spp., *Kentia* sp., *Latania commersoni, Livistonia* sp., *Phoenix* sp., *Roystonea regia.*
Discussion:

This species is extremely close to *Diaspis boisduvalii* Signoret except that it normally shows no trace of the prosomatic lateral lobes, nor does it normally possess submedian groups of pores on the fifth abdominal segment. The question as to whether this is a distinct species can be settled only by much more extended investigations and research. It is here considered to be a distinct species and is treated as such in the present bulletin. See figure 67 as an aid in identifying the species.

California records:

Alameda Co.: Hayward, XII-1934 (J. F. March). Oakland, XI-24-37 (F. J. March).

Kern Co.: Bakersfield, II-19-41 (C. S. Morley).

Los Angeles Co.: Beverly Hills, X-2-40 (V. E. Williams). Los Angeles, V-13-35 (V. E. Williams). Montebello, X-15-37 (V. E. Williams). Pasadena, XI-10-36 (V. E. Williams).

Orange Co.: Corona del Mar, IV-10-41 (K. D. Sloop). Santa Ana, III-20-41.

Sacramento Co.: Sacramento, IV-19-34 (M. L. Jones).

San Diego Co.: Encinitas, VII-5-44 (C. E. Ehmann). San Diego, IV-4-30 (S. L. Lockwood).

San Mateo Co.: San Mateo, IX-27-50 (B. Edwards).

Santa Barbara Co.: Santa Barbara, I-20-41 (F. J. March).

Santa Cruz Co.: Watsonville, II-5-35 (L. B. Sherill).

Ventura Co.: Ventura, II-9-36 (F. R. Lewis).

Diaspis echinocacti (Bouché)
Cactus scale
(Pl. 2, bottom row, right; fig. 69)

Aspidiotus echinocacti Bouché 1883. Naturgeschichte der Schadlichen Garten Insecten, p. 53.

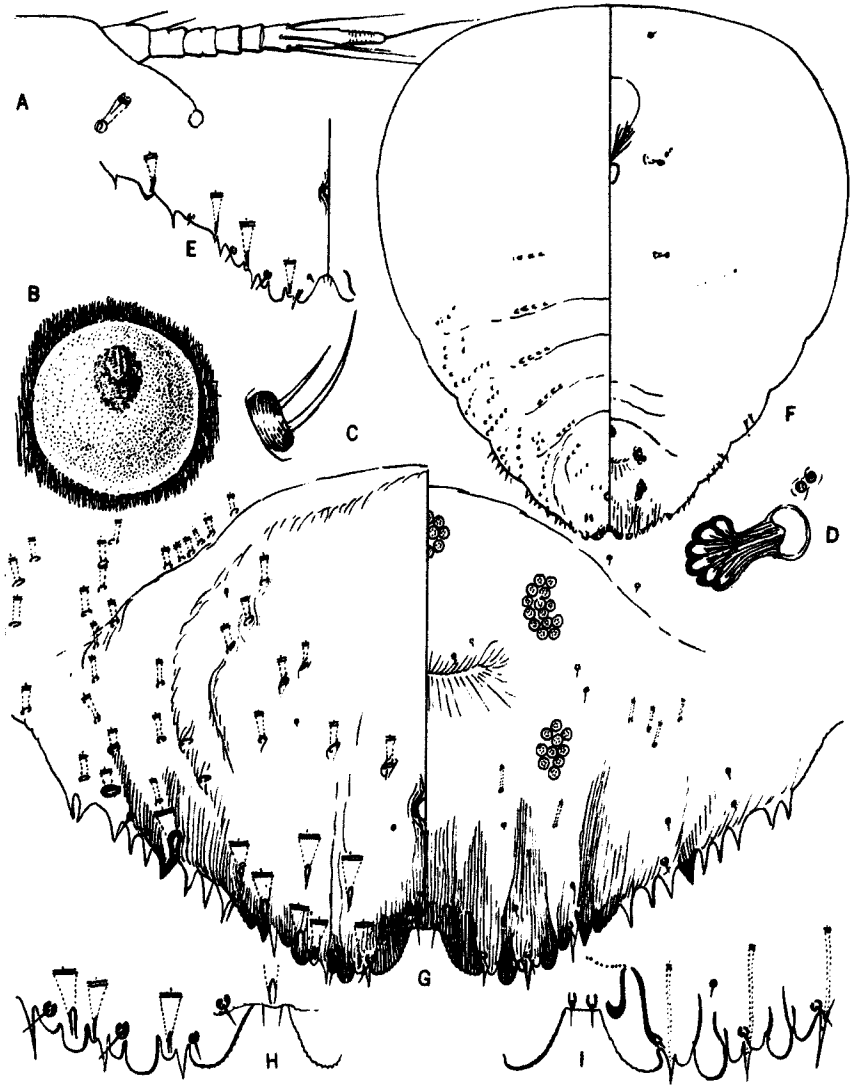

Fig. 70. *Diaspis manzanitae* (Whitney), manzanita scale.

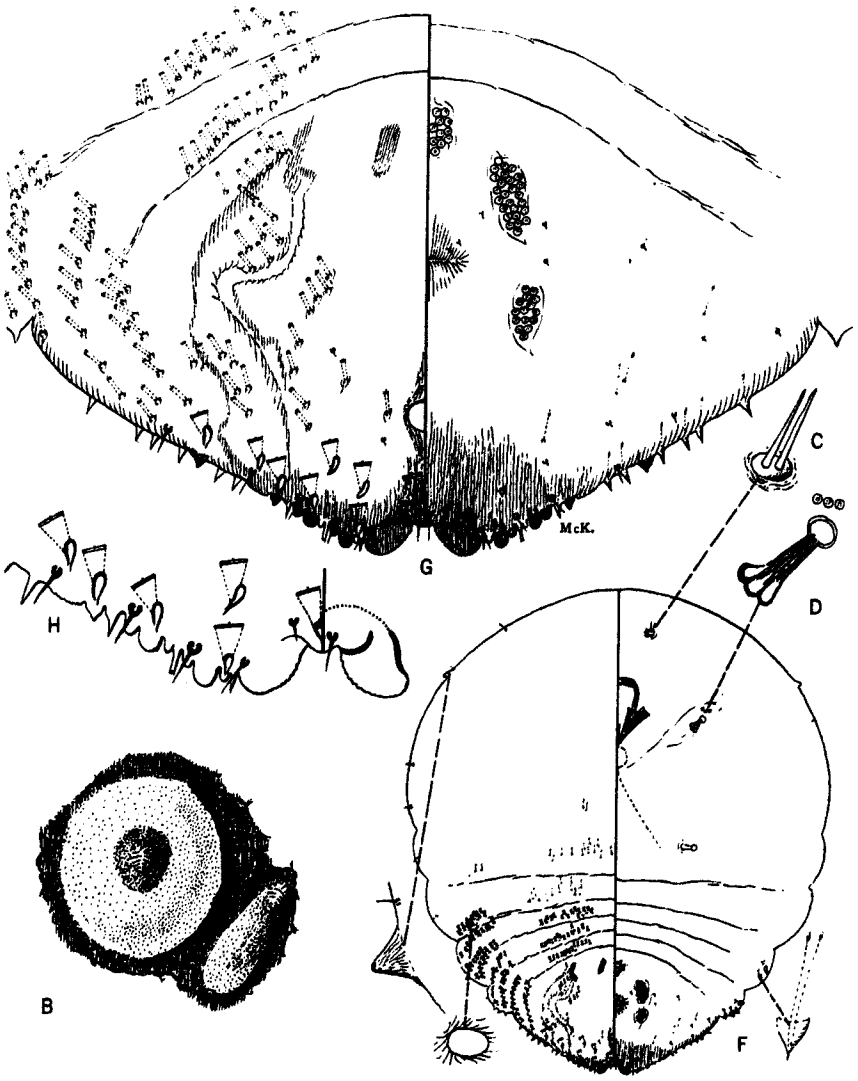

Fig. 71. *Diaspis parasiti* McKenzie, mistletoe scale.

Diaspis calyptroides Costa, 1835. Fauna del Regno di Napoli, Cocciniglie, p. 20.
Diaspis cacti Comstock, 1883, 2d Rep. Dept. Ent. Cornell Univ., p. 91, illus.
Diaspis calyptroides variety *opuntiae* Cockerell, 1893, Jour. Inst. Jamaica, 1:256.
Diaspis echinocacti (Bouché), Ferris, 1937, Atlas of Scale Insects, Ser. I:36.
Type locality: Southern Europe.
Type host: Cactus.
Relation to host: Occurring on the stems, fruit, and leaves. Adult female scale white, circular, flat, exuviae dark, central, or subcentral; male scale elongate, white, felted, exuvium at one end.
Additional hosts: Apparently restricted to the Cactaceae.
Discussion:

The character of the median pygidial lobes, which are all very much the same size, and the association of this species with cacti serve to distinguish this form from other California *Diaspis* species.

California records:

Butte Co.: Palermo, XI-1936 (Fitzgerald).

Fresno Co.: Kingsburg, III-8-37 (F. J. March). Oildale, VII-11-34 (B. L. Fox).

Los Angeles Co.: Los Angeles, X-20-42 (R. H. Smith).

Madera Co.: Madera, XII-9-41 (G. Beevor).

Riverside Co.: Norco, X-1-47 (C. R. Tower). Palm Springs, VIII-27-42 (C. R. Tower).

Sacramento Co.: Sacramento, XII-17-34 (D. H. Custer).

San Bernardino Co.: Redlands, XI-1948.

San Diego Co.: Escondido, X-24-36 (J. Brunton). Ramona, IX-25-37 (R. R. McLean).

San Mateo Co.: Redwood City, X-5-34 (B. B. Martin).

Stanislaus Co.: Modesto, XII-22-31 (E. T. Hamlin).

Ventura Co.: Ojai, XI-24-33 (J. A. Van).

Yuba Co.: Marysville, IX-18-34 (H. A. Crane).

Diaspis manzanitae (Whitney)
Manzanita scale
(Pl. 2, bottom row, left; fig. 70)

Aulacaspis manzanitae Whitney, 1913, Pomona Coll. Jour. Ent. Zool., 5(1):50, illus.
Diaspis manzanitae (Whitney), Ferris, 1937, Atlas of Scale Insects, Ser. I:38.
Type locality: Bowman, Colfax, Dutch Flat, Towle, and Blue Canyon in central California.
Type host: *Arctostaphylos* sp., manzanita.
Relation to host: Occurring on the leaves. Adult female scale light brown, moderately convex, circular, and with a subcentral exuviae; male scale unknown.
Additional hosts: Known only from *Arctostaphylos* spp.
Discussion:

This species is rather closely related to *Diaspis parasiti* McKenzie, differing from it in possessing dorsal submedian groups of macroducts from the pygidium to metathorax. A few dorsal microducts are in this same area in *D. parasiti.* Furthermore, *D. manzanitae* is apparently restricted to manzanita whereas *parasiti* is found only on mistletoe.

California records:

Butte Co.: Paradise, III-28-39 (R. Swett).

Los Angeles Co.: Arroyo Seco Canyon near Pasadena, IV-3-32 (L. E. Myers). San Dimas Canyon, X-17-37 (V. E. Williams). Saugus, IV-17-40.

San Bernardino Co.: Redlands, IV-20-10 (L. (Childs).

San Diego Co.: Jacumba, III-1939 (G. F. Ferris).

Santa Barbara Co.: Guadalupe (R. Patterson).

Santa Clara Co.: Saratoga (near), XII-?-17 (G. F. Ferris).

Shasta Co.: Castella, VI-19-33 (E. Bethel). Redding, 1914 (R. W. Doane).

Tulare Co.: Three Rivers, III-11-49 (O. L. Hemphill).

Diaspis parasiti McKenzie
Mistletoe scale
(Fig. 71)

Diaspis parasiti McKenzie, 1947, Calif. Dept. Agric. Bull., 36(3):108-109, illus.
Type locality: San Jacinto, Riverside Co., California.
Type host: *Phoradendron flavescens,* American mistletoe.
Relation to host: Occurring on the so-called leaves of the host. Adult female scale light brown, circular, with exuviae central; scale of the male elongate, quite similar in color to that of the female, exuvium near one end.
Additional hosts: Known only from mistletoe.
Discussion:

This species is related to *Diaspis manzanitae* (Whitney) differing from it in possessing only dorsal submedian groups of microducts from the

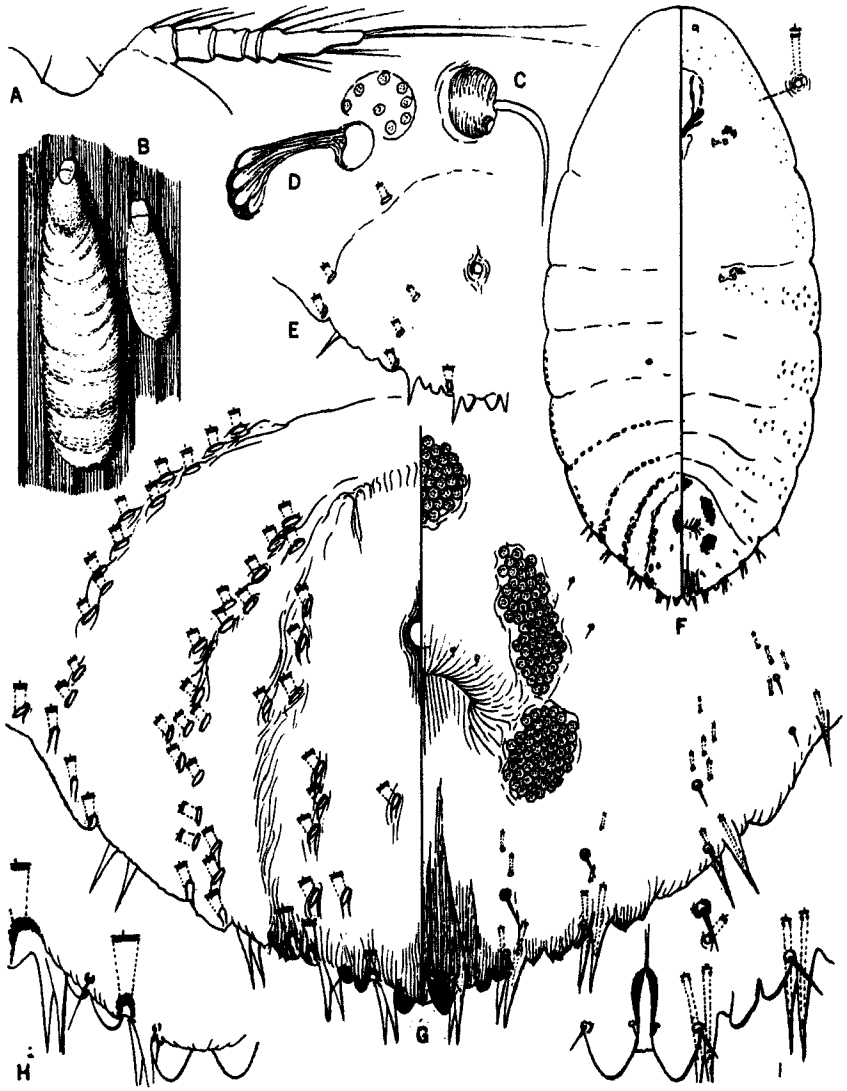

Fig. 72. *Duplachionaspis spartinae* (Cŏmstock), cord grass scale.

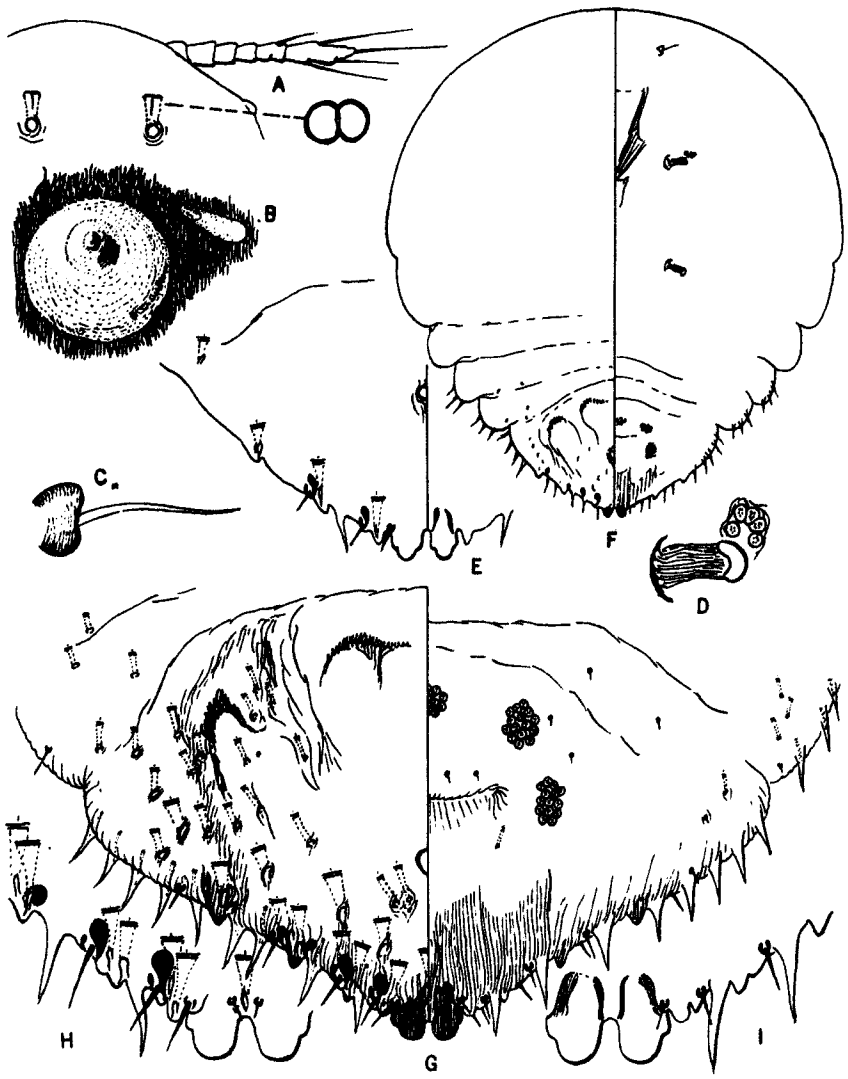

Fig. 73. *Epidiaspis leperii* (Signoret), Italian pear scale.

pygidium to metathorax, whereas in *manzanitae* there are macroducts in these positions. Furthermore. *D. parasiti* infests only mistletoe whereas *D. manzanitae* is found on manzanita.

California records:

Imperial Co.: Winterhaven district, III-23-55 (G. Beevor).

Riverside Co.: Coachella, XI-15-49 (R. W. Harper, G. Beevor and R. M. Hawthorne). Indio, XI-30-48 (R. C. Dickson). San Jacinto, VII-23-46 (R. P. Allen).

Duplachionaspis spartinae (Comstock)
Cord grass scale
(Fig. 72)

Chionaspis spartinae Comstock, 1883, 2d Rep. Dept. Ent. Cornell Univ., p. 106, illus.

Duplachionaspis spartinae (Comstock), Ferris, 1937, Atlas of Scale Insects, Ser. I:48.

Type locality: Woods Hole, Massachusetts.

Type host: *Spartina stricta,* cord grass.

Relation to host: Infesting the dorsal or top side of the leaves of the host. Adult female scale conspicuously white, elongate, rather rough, transversely quite convex, exuviae at one end; male scale elongate, similar in color to that of adult female, exuvium terminal.

Additional hosts: Recorded only from *Spartina stricta.*

Discussion:

The numerous dorsal pygidial macroducts, together with the scales association with *Spartina,* should readily differentiate this species from other related forms.

California records:

Napa Co.: Russ Island, VII-21-53 (H. H. Keifer).

San Diego Co.: Coronado Beach, VIII-17-15 (E. Bettel).

San Francisco Co.: San Francisco Bay, 1916 (G. F. Ferris).

Santa Clara Co.: Santa Clara, (G. F. Ferris).

Epidiaspis leperii (Signoret)
Italian pear scale
(Fig. 73)

Diaspis leperii Signoret, 1869, Ann. Soc. ent. Fr., Series 4(9):437 (=*leperii,* an inadmissible emendation of the original spelling).

Diaspis pyri Colveé, 1881. Estudios sobre algunos Insectos de la familia de los Coccidos, p. 33.

Aspidiotus piricola Del Guercio, 1894. Il Naturalista Siciliano, p. 142 (=*pyricola,* misspelling).

Diaspis ostreaeformis Signoret, 1869, Ann. Soc. ent. Fr., Ser. 4(9):439 (preoccupied).

Diaspis fallax Horvath, 1897, Rev. Ent. Fr., 16:95. Ferris (1937) indicates that "According to Lindinger all these names are synonyms of the still earlier *Aspidiotus betulae* Baerensprung, but this seems to be quite conjectural. The synonymy with *Diaspis leperii* Signoret, however, seems quite clear. *Diaspis snowii* Hunter was erroneously referred to synonymy with this species by the Fernald Catalogue."

Epidiaspis leperii (Signoret), Ferris, 1937, Atlas of Scale Insects, Ser. I:51.

Type locality: France.

Type host: *Prunus persica,* peach..

Relation to host: Infesting the bark, often hidden under lichens. Adult female scale white or gray, circular, the exuviae subcentral; male scale elongate, white felted, noncarinate, exuvium at one end.

Additional hosts: The hosts of this species are normally rosaceous trees such as prune, plum, and pear. The scale occurs abundantly on Christmas Berry, *Photinia (Heteromeles) arbutifolia,* and has also been collected on maple, *Acer* sp., and walnut, *Juglans* sp., in California.

Discussion:

This species is commonly known as the "Italian Pear Scale" of economic entomologists. It differs from *Epidiaspis salicicola* Ferris in either completely lacking second pygidial lobes or these represented only as a mere point, whereas in *E. salicicola* these lobes are well developed.

California records:

This species is widespread in California. A few of the specific locality records are listed below:

Alameda Co.: Niles, I-30-40 (J. B. Steinweden). Oakland, X-2-41 (M. R. Bell).

Butte Co.: Paradise, VIII-20-43 (E. H. Fosen).

Colusa Co.: Colusa, III-15-48 (H. W. Gray).

Contra Costa Co.: Danville, X-16-41 (M. R. Bell).

Kings Co.: Hanford, III-7-41 (T. B. Gallion).

Los Angeles Co.: La Habra, XII-4-42 (H. Mitchell). Los Angeles, IX-27-39 (C. R. Tower).

Marin Co.: San Rafael, I-2-41 (M. R. Bell).

Merced Co.: Merced, V-2-42 (J. Wilson).

Napa Co.: Napa, XII-10-43 (S. V. Weimer).

Nevada Co.: Nevada City, VII-15-47 (J. W. Dixon).

Sacramento Co.: Carmichael, III-5-39 (M. L. Jones). Elk Grove, I-20-31 (A. C. Browne). Sacramento, III-24-31 (C. Haenggi).

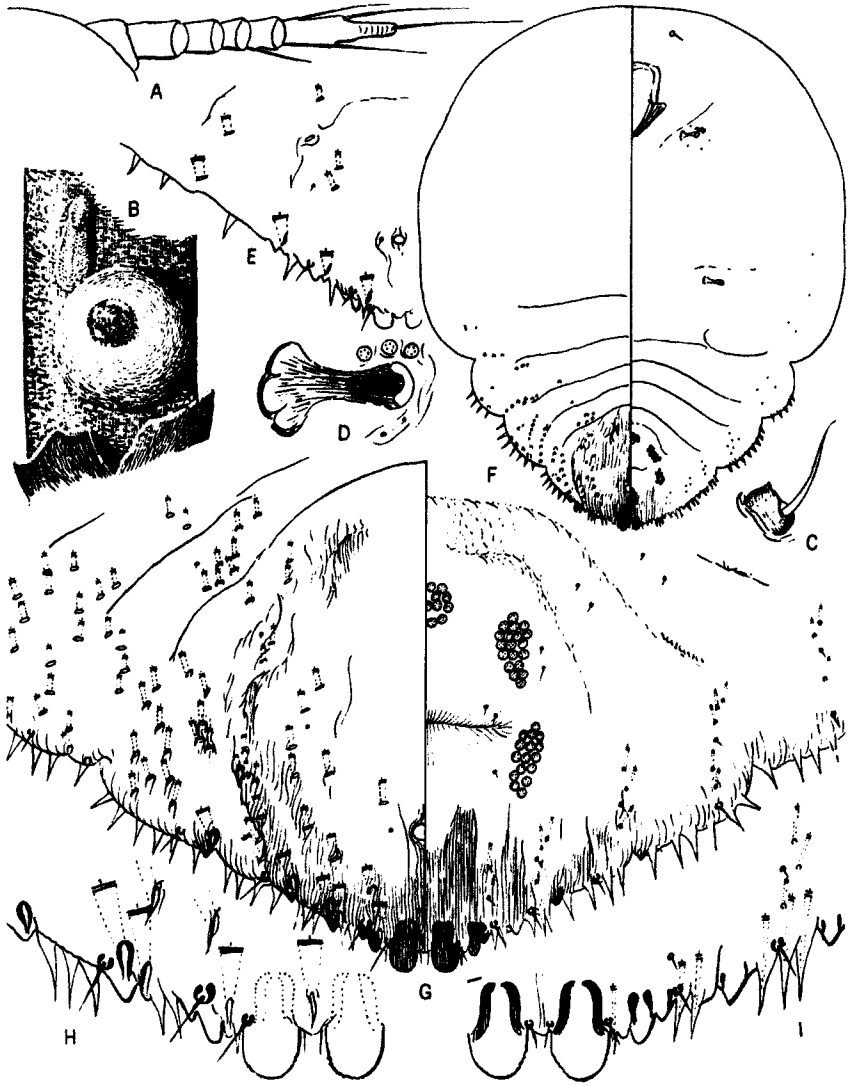

Fig. 74. *Epidiaspis salicicola* Ferris, salicicola scale.

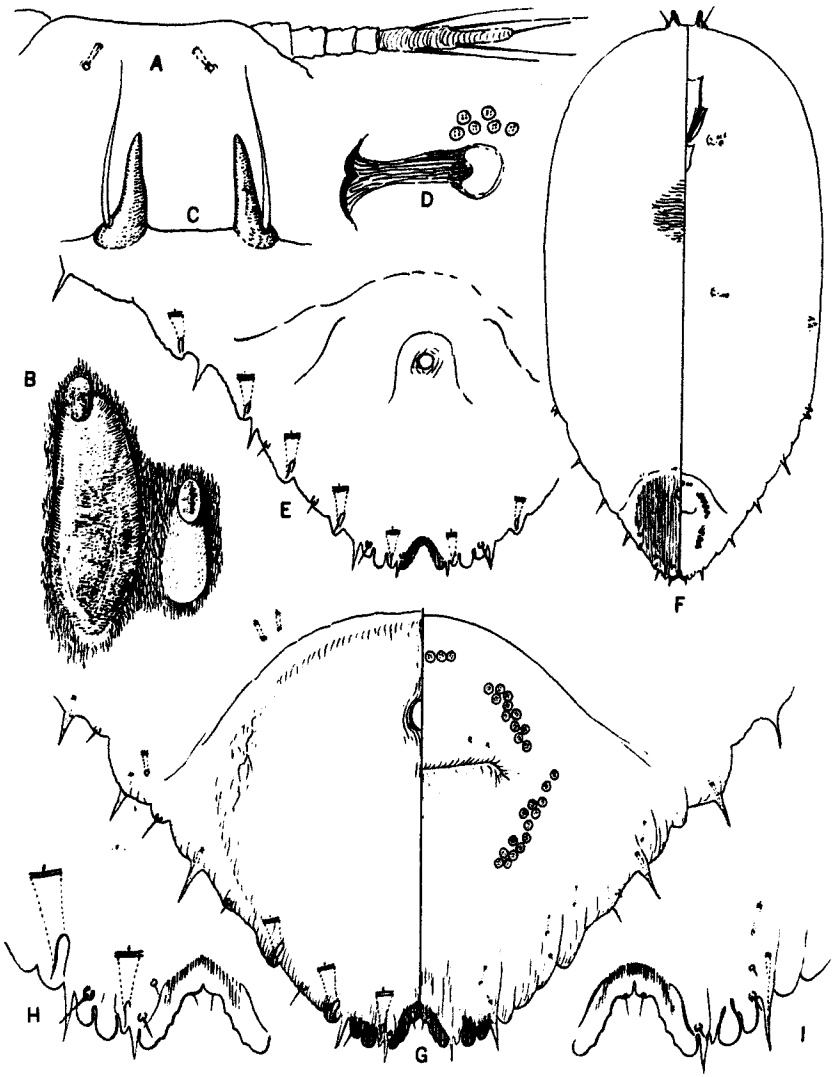

Fig. 75. *Fiorinia fioriniae* (Targioni), palm fiorinia scale.

San Diego Co.: Fallbrook, III-15-44 (S. V. Weimer and G. F. Prole). Warner Hot Springs, III-26-43 (H. Mitchell).

San Joaquin Co.: Stockton, III-21-38 (P. F. Wright).

San Luis Obispo Co.: San Luis Obispo, XI-25-47.

San Mateo Co.: Burlingame, VIII-20-41 (I. J. Campbell). Redwood City, III-6-39 (I. J. Campbell).

Santa Clara Co.: Campbell, I-28-48 (T. B. Gallion). Gilroy, X-14-32 (B. B. Whitney). Palo Alto, III-15-34 (G. Becker). San Jose, XII-30-29 (S. L. Lockwood).

Santa Cruz Co.: Watsonville, I-12-49 (C. V. Dick).

Solano Co.: Fairfield, I-30-34 (C. H. Wren). Suisun, VI-19-40 (H. W. Marshall). Vallejo, XI-26-40 (H. W. Marshall).

Stanislaus Co.: Modesto, III-7-44 (J. Wilson).

Tulare Co.: Reedley, III-13-41 (O. A. Hemphill). Visalia, I-8-41 (O. A. Hemphill).

Ventura Co.: Ojai, XI-3-32 (E. L. Smith).

Yolo Co.: Davis, XI-10-47.

Epidiaspis salicicola Ferris
Salicicola scale
(Fig. 74)

Epidiaspis salicicola Ferris, 1938, Atlas of Scale Insects, Ser. II:142, illus.

Type locality: Phoenix, Arizona.

Type host: *Phoradendron californicum*, mesquite mistletoe.

Relation to host: Occurring exposed on the small twigs of its host. Adult female scale brownish, slightly darker than straw-color, circular, rather convex, exuviae subcentral; male scale straw-colored and with a very faint median carina, exuvium at one end.

Additional hosts: *Populus* sp., and *Salix*.

Discussion:

Related to *Epidiaspis leperii* (Signoret) but differing from it in having well-developed second pygidial lobes.

California records:

Kern Co.: Bakersfield, XI-4-41 (T. B. Gallion).

Ventura Co.: Fillmore, 1935 (E. L. Smith).

Fiorinia fioriniae (Targioni)
Palm fiorinia scale
(Fig. 75)

Diaspis fioriniae Targioni, 1867. Studii sulle Cocciniglie, p. 14.

Fiorinia pellucida Targioni, 1869. Introduzione alla seconda memoria per gli studi Salle cocciniglie, e catalogus dei gen. e sp. della famiglia, p. 42.

Fiorinia camelliae Comstock, 1881, Rep. U.S.D.A. for 1880, p. 329.

Ubleria fioriniae (Targioni), Comstock, 1883, 2d Rep. Dept. Ent. Cornell Univ., p. 111.

Ubleria camelliae (Comstock), Comstock, 1883, 2d Rep. Dept. Ent. Cornell Univ., p. 111.

Fiorinia palmae Green, 1896, Ind. Mus. Notes, 4:5.

Fiorinia fioriniae (Targioni), Ferris, 1937, Atlas of Scale Insects, Ser. I:55.

Type locality: Europe.

Type host: Not known to writer.

Relation to host: Occurring normally on the leaves. Adult female scale yellowish or brown, elongate, quite translucent, composed of the second skin, with perhaps a slight terminal waxy appendage, first exuvium at anterior end; male scale white, felted exuvium terminal.

Additional hosts: This species infests a long list of hosts usually in greenhouses. It seems to favor palms especially. A few of its hosts include *Anthurium, Camellia, Hedera, Ilex, Laurus, Persea, Leptospermum laevigatum, Phoenix, Podocarpus, Rhus, Strelitzia,* and *Taxus*.

Discussion:

This species is a common greenhouse scale. The pygidial margin has but three or occasionally four large, and no small, macroducts; this character normally serves to distinguish it from other California *Fiorinia*.

California records:

This species is quite common in California nurseries. A few of the specific localities are listed below:

Alameda Co.: Hayward, X-7-41 (M. R. Bell). Oakland, XI-3-32 (B. B. Whitney).

Riverside Co.: Riverside, I-29-49.

San Diego Co.: Coronado, II-8-36 (J. G. Brunton). Pacific Beach, XI-18-42 (D. F. Palmer). San Diego, XII-2-31 (S. B. Osborn).

Tulare Co.: Exeter, V-18-43 (J. M. Awbrey).

Yuba Co.: Marysville, III-8-48.

Fiorinia japonica Kuwana
Coniferous fiorinia scale
(Fig. 76)

Fiorinia fioriniae variety *japonica* Kuwana, 1902, Proc. Calif. Acad. Sci., 3(3):79.

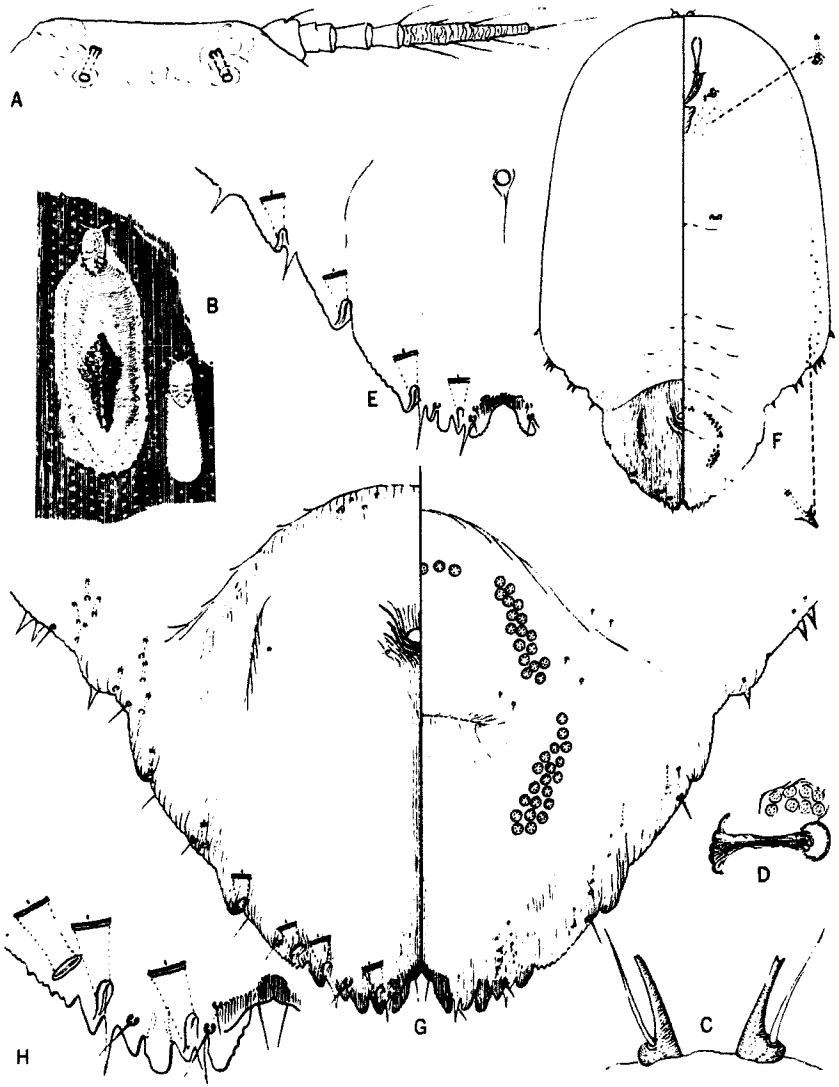

Fig. 76. *Fiorinia japonica* Kuwana, coniferous fiorinia scale.

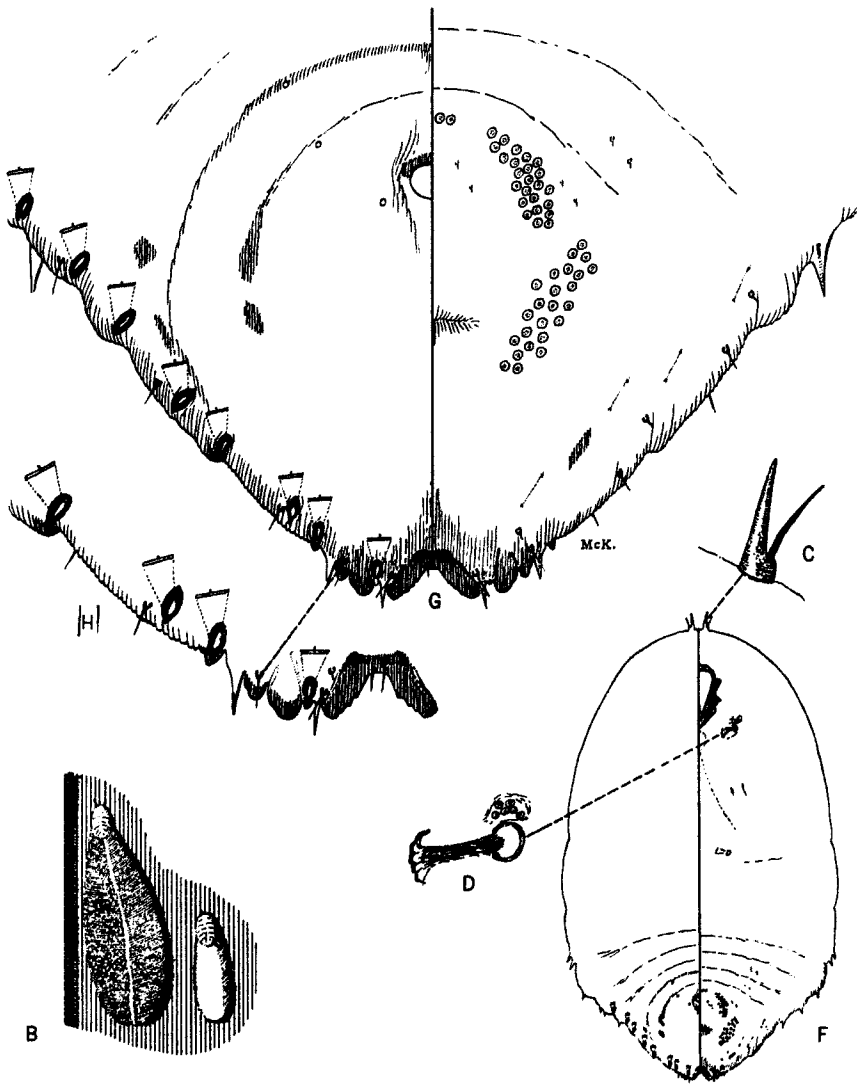

Fig. 77. *Fiorinia juniperi* (Bouché), juniper fiorinia scale.

Fiorinia japonica Kuwana, Ferris, 1942, Atlas of Scale Insects, Ser. IV:394.
Type locality: Tokyo, Gifuken, and Shigaken, Japan.
Type host: *Podocarpus macrophyllus maki (chinensis)* and *Pinus* sp.
Relation to host: Occurring on the needles. Adult female scale pale yellowish-brown, composed chiefly of the enlarged second exuvia which is covered with a thin film of wax, sometimes with darker median area and bordered with a narrow fringe of a secretionary waxy material; male scale elongate, white, with a terminal exuvium.
Additional hosts: *Abies* spp., *Cedrus atlantica, Podocarpus* spp., and *Tsuga* spp.
Discussion:

This species is very specific in its host preferences, being restricted to coniferous representatives. It is characterized by possessing four large marginal pygidial macroducts followed by a few smaller macroducts, and the antennae are noticeably enlarged and set at the apex of the head. The pygidium is not elongate.
California records:

Los Angeles Co.: Culver City, II-2-42. Harbor City, II-25-38 (V. E. Williams). Los Angeles, XII-14-38 (J. B. Steinweden). San Pedro, IV-11-38 (L. E. Myers).

Fiorinia juniperi (Bouché)
Juniper fiorinia scale
(Fig. 77)

Aspidiotus juniperi Bouché, 1851, Stettin. Ent. Ztg., 12:112.
Diaspis juniperi (Bouché), Signoret, 1869, Ann. Soc. ent. Fr., 4(9):437.
Type locality: Europe.
Type host: *Juniperus communis,* common juniper.
Relation to host: Occurring on the leaves of its host. Adult female scale pale yellowish-brown, elongate, composed of a second skin, exuviae at one end, often covered by a whitish secretion; male scale elongate, white, felted, exuvium terminal.
Additional hosts: *Podocarpus.*
Discussion:

This species has been found only in California nurseries. It has persisted in at least one northern California nursery for a period of more than ten years. Recent control measures in this nursery have, however, apparently eradicated the scale.

It is different from other California *Fiorinia* by having seven or eight large macroducts on one side along pygidial margin instead of five or less of these structures in this position.
California records:

Alameda Co.: Berkeley, XI-12-48 (G. B. Laing). Hayward, V-3-39 (F. J. March). Oakland, XI-3-32 (B. B. Whitney).

Los Angeles Co.: Gardena, V-5-53 (L. E. French).

Fiorinia theae Green
Tea scale
(Fig. 78)

Fiorinia theae Green, 1900, Ind. Mus. Notes, 5:3.
Fiorinia theae Green, Ferris, 1942, Atlas of Scale Insects, Ser. IV:395.
Type locality: India.
Type host: *Camellia sinensis,* common tea.
Relation to host: Occurring on the leaves. Adult female scale composed chiefly of the sclerotized second exuvia, which has a longitudinal elevated ridge covered by a very thin film of wax, quite dark brown, elongate oval, and with the posterior end quite pointed; male scale elongate, white, with a terminal exuvia.
Additional hosts: *Camellia* spp., *Eurya, Ilex* spp., and *Olea glandulifera.*
Discussion:

This species is readily recognizable from other California *Fiorinia* by the small marginal ducts of the pygidium and by the tubular process between the antennae.

Fiorinia theae Green has been found only in California nurseries. Whenever found, however, it is eradicated.
California records:

Contra Costa Co.: El Cerrito, I-18-45 (M. R. Bell).

Fresno Co.: Fresno, X-23-52 (H. V. Dunnegan).

Los Angeles Co.: Glendale, VI-4-41. Pasadena, I-31-41. Pomona, I-19-44. Sierra Madre, IX-12-41. Temple City, VII-16-41.

Orange Co.: Costa Mesa, II-20-47 (J. B. Walden and L. J. Liekhus).

Santa Clara Co.: Los Gatos, I-27-53 (A. Mutzenberg and C. Howe).

Furchadiaspis zamiae (Morgan)
Cycad scale
(Fig. 79)

Diaspis zamiae Morgan, 1890, Ent. Mon. Mag., 26:44.

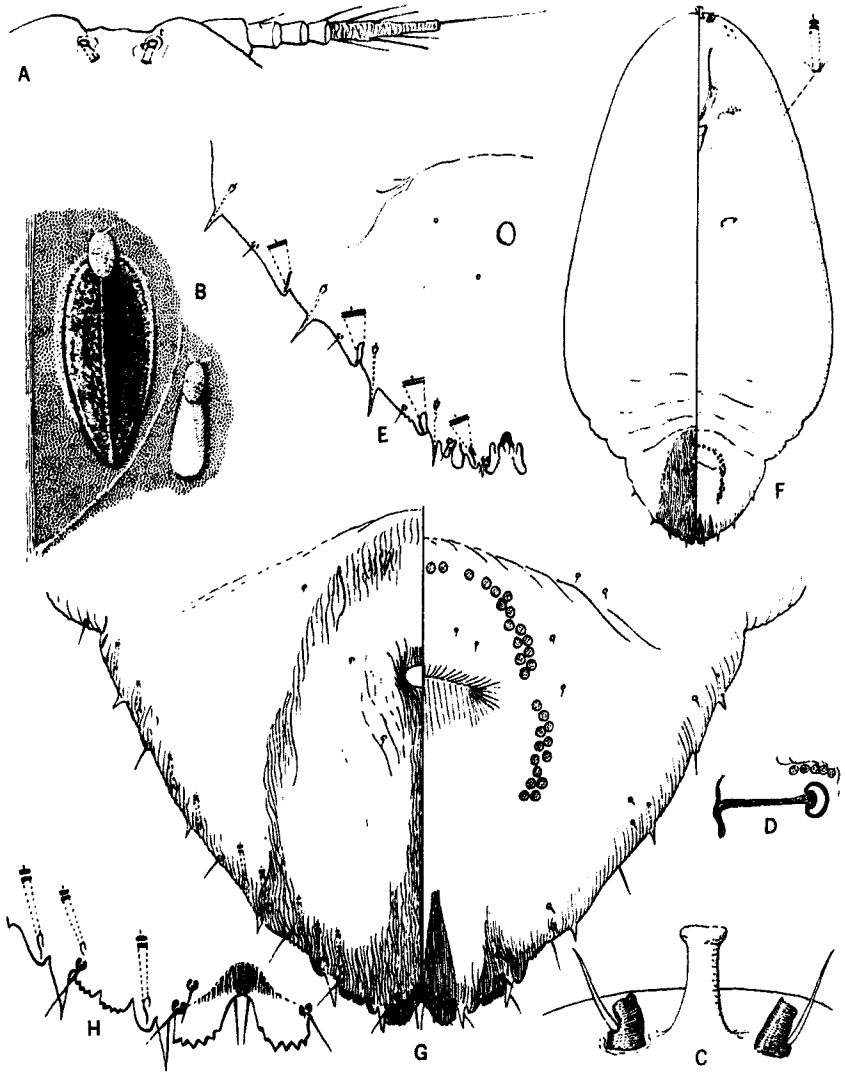

Fig. 78. *Fiorinia theae* Green, tea scale.

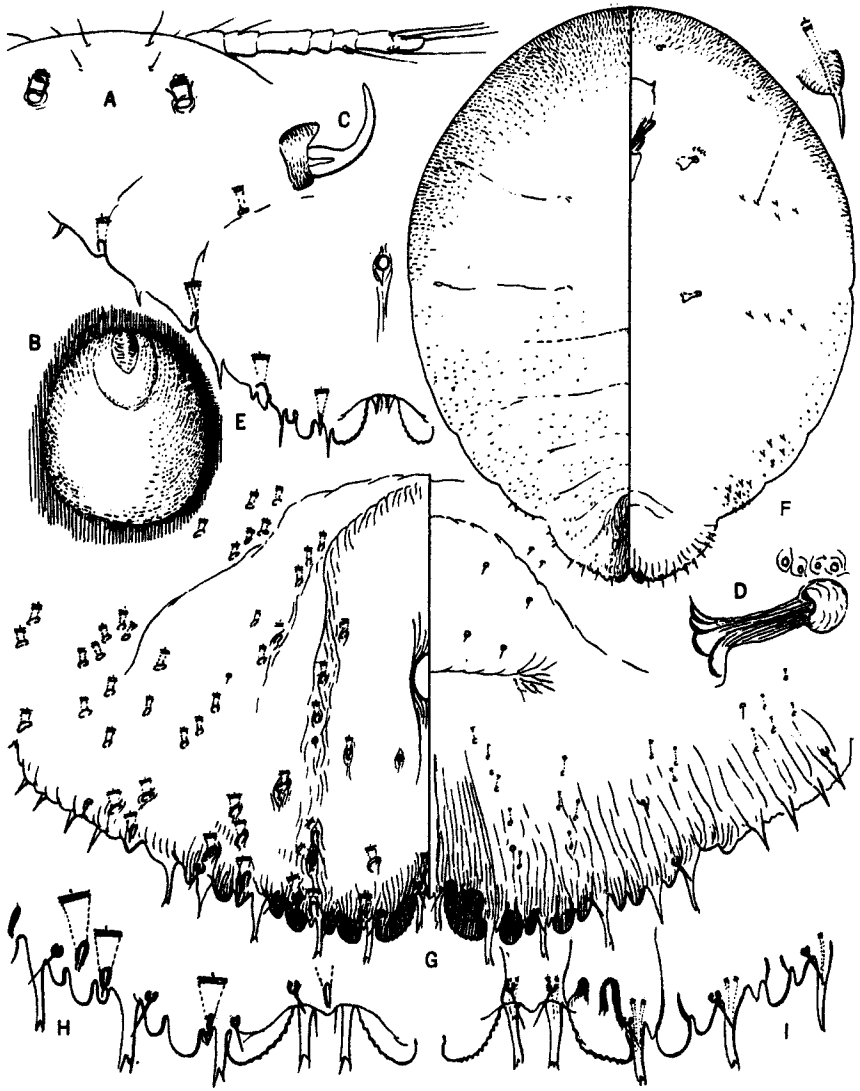

Fig. 79. *Furchadiaspis zamiae* (Morgan), cycad scale.

Howardia elegans Berlese and Leonardi, 1895. Chermotheca Italica 1(18).

Aulacaspis elegans (Berlese and Leonardi), King, 1899, Psyche, 8:350.

Furchadiaspis zamiae (Morgan), Ferris, 1937, Atlas of Scale Insects, Ser. I:59.

Type locality: Oporto, Portugal.

Type host: *Zamia villosa.*

Relation to host: Occurring on the leaves. Adult female scale white, oval, or subcircular, moderately convex, exuviae at one end; male scale unknown.

Additional hosts: This species normally infests various cycads of the genera *Cycas* and *Zamia.* Only one exception has been recently noted on *Strelitzia nicolai* in a California nursery.

Discussion:

The host specificity of this scale insect aids in its identification. Superficially it resembles a *Diaspis* but lacks perivulvar pores and possesses numerous dorsal ducts which are scattered over the abdomen. No other members of this genus are represented in California.

The species occurs on the leaves of various cycads and is rather frequently found in California nurseries.

California records:

Alameda Co.: Oakland, IV-17-39 (F. J. March).

Los Angeles Co.: Hawthorne, VII-9-40. Inglewood, III-10-38. Los Angeles, XI-4-54 (C. W. Bridges). San Marino, VI-13-38 (V. E. Williams). Santa Monica, V-19-52 (G. Beevor).

San Francisco Co.: San Francisco, (O. E. Bremner).

San Mateo Co.: Millbrae, X-19-31 (F. J. March).

Santa Clara Co.: Palo Alto, 1917 (G. F. Ferris).

Howardia biclavis (Comstock)
Mining scale
(Fig. 80)

Chionaspis (?) *biclavis* Comstock, 1883, 2d Rep. Dept. Ent. Cornell Univ., p. 98.

Megalodiaspis biclavis (Comstock), Malenotti, Paoli, 1915, Redia, 11:256.

Howardia biclavis (Comstock), Ferris, 1937, Atlas of Scale Insects, Ser. I:65.

Type locality: Washington, D.C. (in a conservatory).

Type host: According to Comstock (1883), "It has been found upon the following named plants: *Diospyros ebenum, Ficus laurifolia,* a species of *Tamarindus,* and according to my notes, upon two plants labeled *Achras zapota* and *Elaeocarpus cyaneus,* respectively."

Relation to host: Occurring on the leaves, twigs, and certain fruits. Adult female scale very large, measuring from 2.5 to 3 mm. in diameter, broadly oval to almost circular, white or gray-white, usually concealed beneath epidermis of host thus obscuring its color, exuviae submarginal; male scale not known, the species probably being parthenogenetic.

Additional hosts: Recorded from a long list of hosts a few of which include: *Acalypha, Allamanda cathartica* var. *Schottia, Andira, Annona, Begonia, Bixa, Camellia, Carica, Castanea, Casuarina, Cinnamomum, Citrus, Coffea, Euphorbia pulcherrima, Ficus, Flacourtia, Hibiscus, Jasminum, Ligustrum, Microglossa, Plumeria, Punica,* and *Wistaria.*

Discussion:

This is the so-called "mining or bi-clavate" scale of economic entomologists.

The scale has the habit of burrowing beneath the epidermal layer of the twig or leaf which it infests. It is invariably obscured by the layer of tissue under which the scale has grown. The large size of this species, together with its heavily sclerotized and broadly turbinate prosomatic region and the prominent median lobes each with a conspicuous club-shaped sclerosis, makes identification a relatively simple matter.

In California it is principally a nursery pest and whenever found has been the object of rigid treatment, often resulting in complete plant destruction. An infestation noted in 1929 in a glass conservatory in Golden Gate Park, San Francisco, California, has persisted for over twenty years in spite of applied control measures.

California records:

Los Angeles Co.: Brentwood, IV-8-41. Montebello, V-27-43. West Los Angeles, X-16-40.

San Diego Co.: Encinitas (quarantine from Walnut Creek, Solano County, California), IX-16-47 (H. L. Oldham). San Diego, VII-3-42 (D. F. Palmer).

San Francisco Co.: San Francisco, IX-1929 (J. B. Steinweden).

Kuwanaspis pseudoleucaspis (Kuwana)
Bamboo diaspidid
(Fig. 81)

Leucaspis bambusae Kuwana, 1902, Proc. Calif. Acad. Sci., 3(3):74, illus.

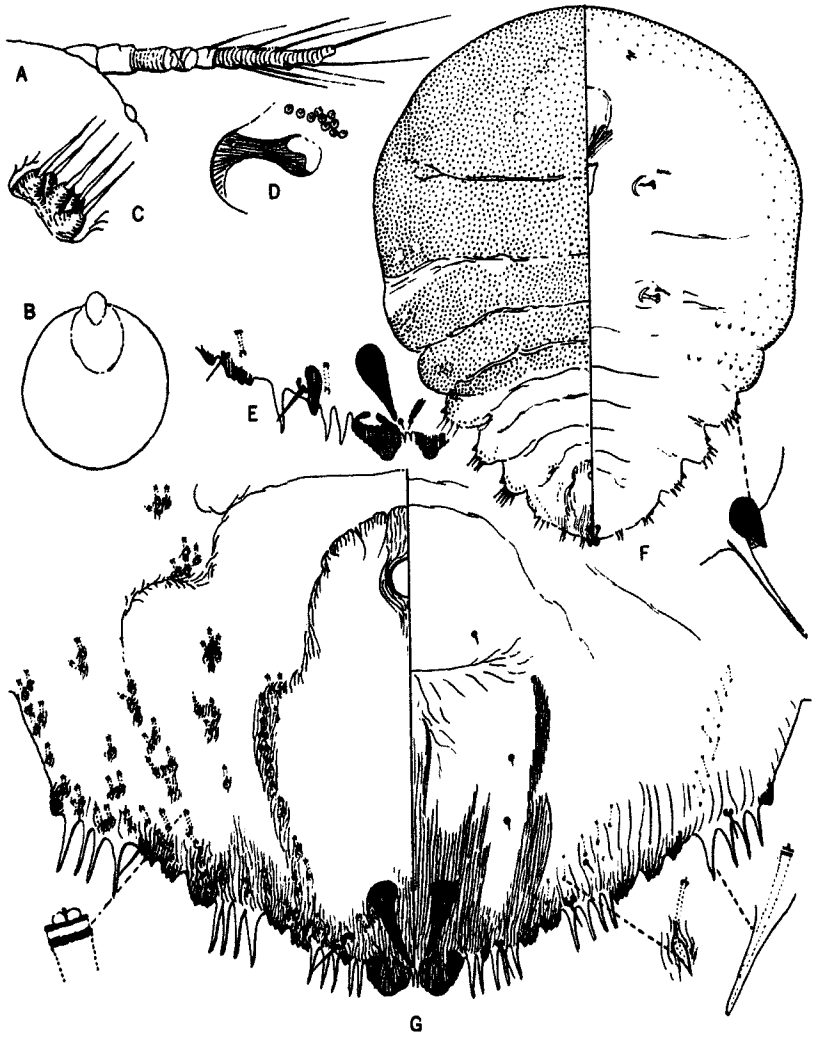

Fig. 80. *Howardia biclavis* (Comstock), mining scale.

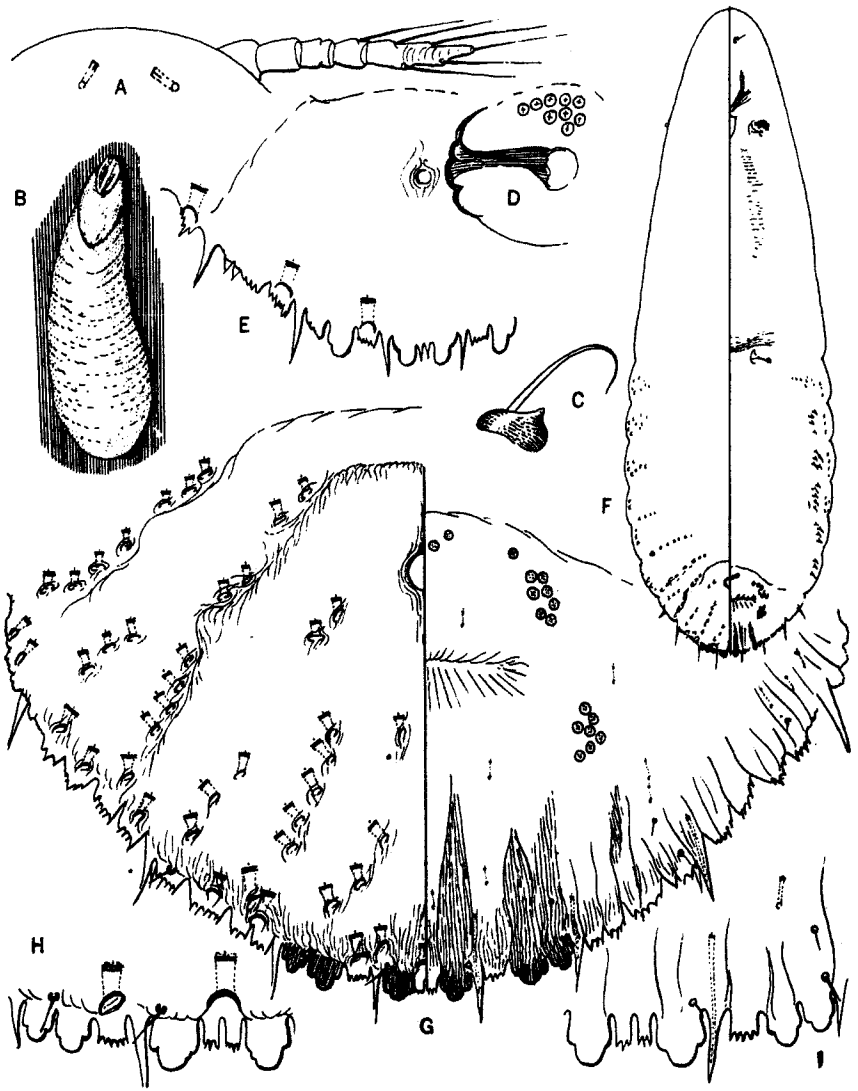

Fig. 81. *Kuwanaspis pseudoleucaspis* (Kuwana), bamboo diaspidid.

Chionaspis pseudoleucaspis Kuwana, 1923. Dobuts ugaku-zasshi, 35:323.

Tsukushiaspis pseudoleucaspis (Kuwana), Kuwana, 1928. Minist. Agric. Forest., Japan, Sci. Bull., No. 1:31, illus.

Kuwanaspis pseudoleucaspis (Kuwana), Ferris, 1941, Atlas of Scale Insects. Ser. III:288.

According to Ferris (1941), "the change in specific name from *bambusae* to *pseudoleucaspis* was occasioned by the fact that Kuwana at one time mistakenly referred the species to *Chionaspis*, a genus in which the name *bambusae* preoccupied, a secondary homonym thereby being created. Under the present rules of nomenclature the original name cannot be restored in the case of such secondary homonyms, whatever the error which resulted in a homonym being produced."

Type locality: Kokura, Kiushiu, Japan.

Type host: Bamboo.

Relation to host: Infesting the canes. Adult female white, elongate, moderately broad, exuviae at one end; male scale not seen by me, but according to Kuwana is similar in form and color to adult female, and also possesses a distinct median keel.

Additional hosts: Recorded only from bamboo.

Discussion:

This species occurs only on bamboo in California. There should be no difficulty in separating it from any other California diaspidid.

California records:

Los Angeles Co.: Camarillo, VII-28-55 (W. M. Jones). Harbor City, II-27-47 (L. E. Myers). Los Angeles, IV-26-38 (F. R. Platt).

San Diego Co.: San Diego, IV-6-49 (R. W. Harper).

Santa Barbara Co.: Montecito, V-9-49 (R. W. Harper).

Santa Clara Co.: Palo Alto, III-17-51 (B. Edwards).

Lepidosaphes beckii (Newman)
Purple scale
(Pl. 3, top row, right; fig. 82)

Coccus beckii Newman, 1869, Entomologist, 4:217.

Aspidiotus citricola Packard, 1869, Guide to Study of Insects, p. 527.

Lepidosaphes beckii (Newman), Ferris, 1937, Atlas of Scale Insects, Ser. I:71.

Ferris (1937) says, regarding the synonymy of this species; "The proper name to be applied to this species is in doubt. It is commonly accepted that *Coccus beckii* Newman and *Aspidiotus citricola* Packard are the same species, but Leonardi has indicated that both are the same as the still earlier *Aspidiotus pinnaeformis* Bouché. On the other hand, *pinnaeformis* was originally described from an orchid, and there occur on orchids species of this genus which could easily be confused with *beckii* but are distinct. It appears that the identification of *pinnaeformis* is purely speculative and consequently the opinion is here maintained that it should not replace a name the application of which is definitely known."

Type locality: Europe.

Type host: Orange.

Relation to host: Occurring on the bark, leaves, and fruit. Adult female scale elongate, broader at posterior end, brownish, exuviae at one end; male scale smaller, elongate, similar to female in color, exuvium terminal.

Additional hosts: The principal host of this scale is *Citrus*, and the species is found wherever these fruits are grown throughout the world. It has been, however, recorded from many other hosts, but in view of the possible misidentification of members of *Lepidosaphes*, many of these records are in error. A few of the other authentic hosts include *Buxus*, *Elaeagnus*, and *Ilex*.

Discussion:

This species is known to economic entomologists as the "purple scale" of citrus. The species is perhaps most closely related to *Lepidosaphes ulmi* (Linnaeus), differing from it by the total absence of marginal sclerotized spurs on the abdominal segments which are always present in *ulmi*.

Lepidosaphes beckii is considered a serious pest of *Citrus* in certain coastal areas in southern California.

California records:

A few of the California locality records for this species are given below:

Alameda Co.: Berkeley, IX-25-41 (M. R. Bell).

Contra Costa Co.: Richmond, XII-30-49.

Del Norte Co.: Crescent City, I-20-48 (L. Mobley).

Los Angeles Co.: Inglewood, XII-7-33 (Milbrath). La Habra, XI-17-42 (T. B. Gallion). Los Angeles, V-28-32 (Smoyer). Montebello, V-1935 (V. E. Williams). Whittier, XII-1932 (C. R. Tower).

Orange Co.: Anaheim, VIII-2-38 (A. L. Stratton). Capistrano, III-16-34 (D. W. Tubbs). Newport, XII-9-38 (T. Balkam). Santa Ana, II-16-32 (L. E. Myers).

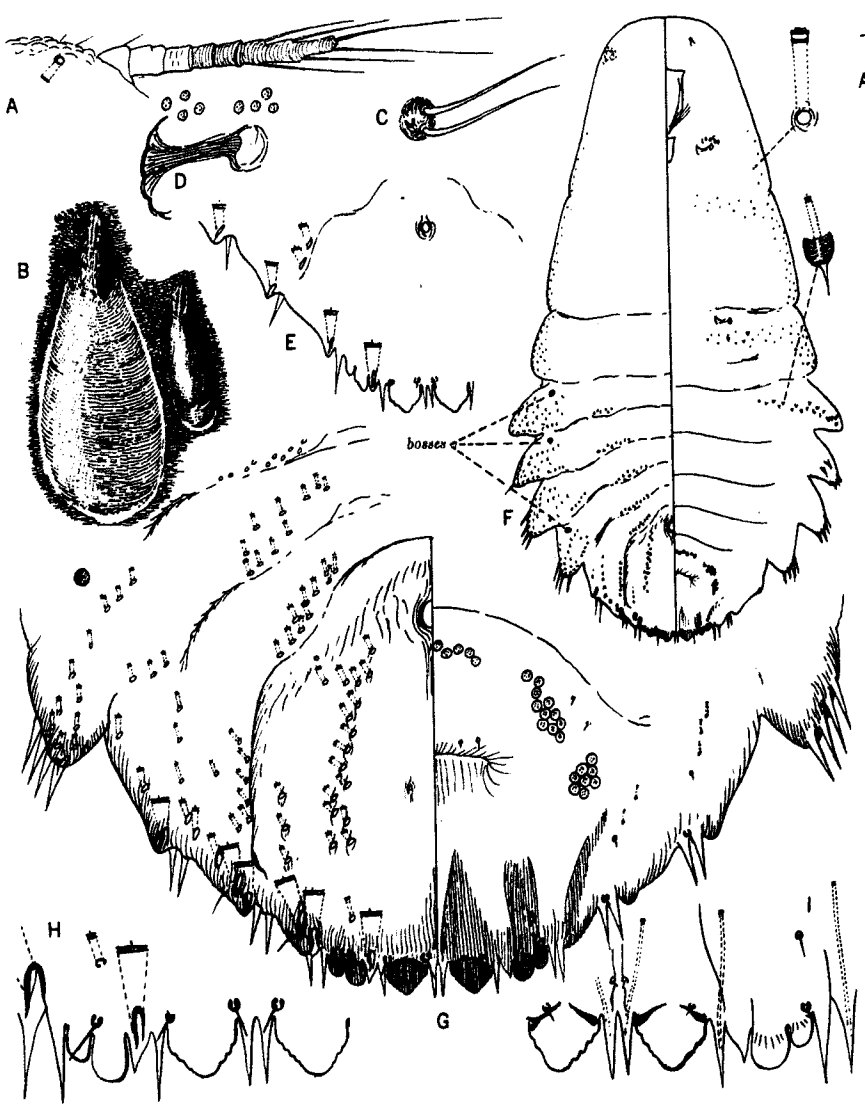

Fig. 82. *Lepidosaphes beckii* (Newman), purple scale.

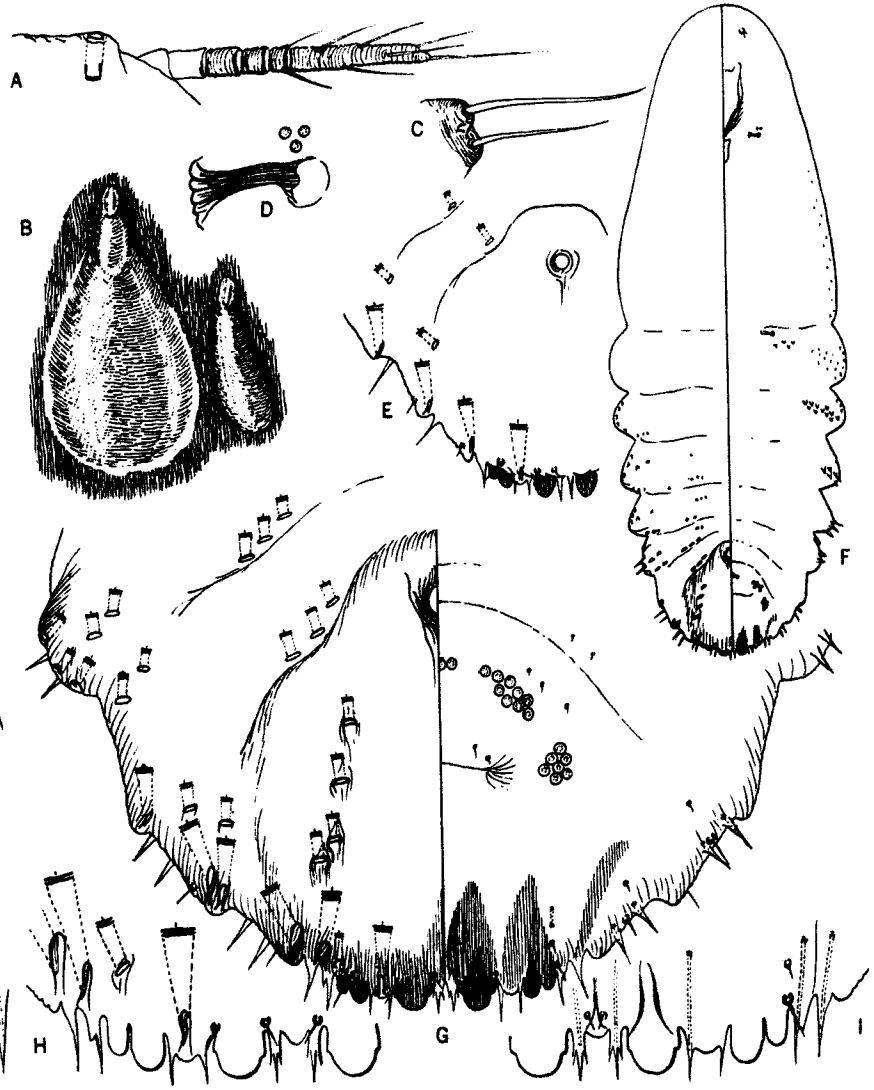

Fig. 83. *Lepidosaphes camelliae* Hoke, camellia scale.

Riverside Co.: Riverside, II-1949.

Sacramento Co.: Sacramento, II-9-46 (J. B. Steinweden).

San Diego Co.: San Diego, XI-22-40 (C. R. Tower).

San Mateo Co.: San Mateo, X-2-29 (A. W. Tate).

Santa Barbara Co.: Goleta, XII-13-32 (G. Woodhams). Santa Barbara, I-16-48.

Santa Clara Co.: Los Gatos, XII-20-39 (R. J. Bumgardner).

Solano Co.: Fairfield, VIII-1940 (H. W. Marshall).

Sutter Co.: Yuba City, VIII-20-34 (C. E. King).

Ventura Co.: Port Hueneme, VIII-21-47 (W. M. Dunning). Santa Paula, XII-20-47 (J. D. Taylor). Ventura, XII-27-47 (V. Holmer).

Lepidosaphes camelliae Hoke
Camellia scale
(Fig. 83)

Lepidosaphes camelliae Hoke, 1922, Ann. Ent. Soc. Amer., 14:339, illus.

Lepidosaphes camelliae Hoke, Ferris, 1937, Atlas of Scale Insects, Ser. I;72.

Type locality: Mississippi (various localities).

Type host: *Camellia japonica.*

Relation to host: Occurring on the leaves. Adult female scale elongate although quite broad and flat, brownish, exuviae at one end; male scale elongate, similar in color to that of adult female, exuvium terminal.

Additional hosts: *Camellia* spp.

Discussion:

This species may be readily recognized by the paucity and large size of the dorsal pygidial macroducts. It has been found only in California nurseries. Whenever detected in a nursery it is given eradicative treatment to prevent further spread.

California records:

Butte Co.: Chico, II-19-42 (J. B. Steinweden and R. Swett).

Contra Costa Co.: El Cerrito, II-27-48 (S. M. Mather).

Fresno Co.: Fresno, VIII-17-43 (M. R. Bell).

Humboldt Co.: Eureka, IV-17-42 (M. R. Bell).

Los Angeles Co.: Pasadena, VII-1939. San Gabriel, VII-31-39.

Orange Co.: Santa Ana, I-19-43 (D. D. Sharp).

Sacramento Co.: Sacramento, IX-24-42 (W. B. Carter and J. B. Steinweden).

San Bernardino Co.: San Bernardino, III-4-41 (G. A. Pohl). Upland, XII-16-43 (A. C. Appel).

San Diego Co.: San Diego, XII-14-44 (D. F. Palmer).

Sonoma Co.: Santa Rosa, III-11-49 (P. F. Wright).

Tulare Co.: Tulare, IX-14-50 (Kalstrom). Visalia, XI-24-41 (J. W. Dixon).

Ventura Co.: Ojai, I-26-42 (R. Young). Ventura, V-13-40 (R. Young).

Lepidosaphes chinensis Chamberlin
Chinese lepidosaphes scale
(Fig. 84)

Lepidosaphes chinensis Chamberlin, 1925, Pan-Pacific Ent., 2:85, illus.

Lepidosaphes chinensis Chamberlin, Ferris, 1938, Atlas of Scale Insects, Ser. II:143.

Type locality: Canton, China.

Type host: *Magnolia.*

Relation to host: Occurring on the leaves and stems of host. Adult female scale elongate, moderately broad, dark reddish-brown, exuviae at one end; male scale quite long and slender, similar in color to that of adult female, exuvium at one end.

Additional hosts: *Cymbidium* sp. (orchid).

Discussion:

This species may be distinguished from *Lepidosaphes beckii* (Newman) by the presence of marginal spurs and sclerotized bosses on segments one to five, whereas in *beckii* the marginal spurs are lacking and the sclerotized bosses are present only on segments one, two, and four. It differs from *Lepidosaphes ulmi* (Linnaeus) in having the sclerotized bosses on segments one to five, these usually lacking in *ulmi.*

California records:

Los Angeles Co.: Los Angeles, VII-17-34 (A. Toyne); V-29-35 (V. E. Williams).

Lepidosaphes destefanii Leonardi
De Stefan scale
(Fig. 85)

Lepidosaphes destefanii Leonardi, 1907, Bull. Lab. Zool. Portici, 1:167, illus.

Mytilococcus destefanii (Leonardi), Pegazzano, 1951, Redia, 36:291-299, illus.

Lepidosaphes destefanii Leonardi, Armitage, 1952, 33d Ann. Rep., Calif. Dept. Agric., Sacramento, 41(4):209.

Type locality: Italy.

Type host: *Phillyrea media* (Oleaceae).

Relation to host: Occurring on the bark. Adult female scale narrow, elongate, grayish-brown, often covered with epidermis from plant, exuviae at one end; male scale not seen.

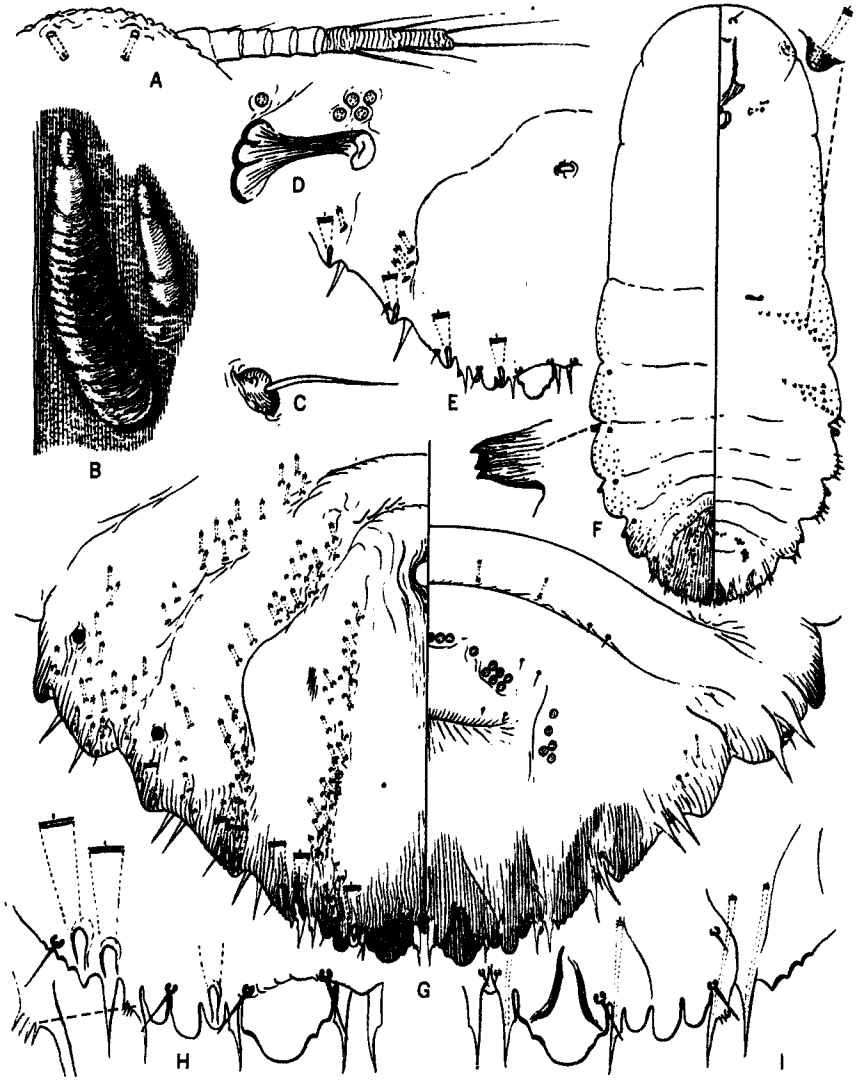

Fig. 84. *Lepidosaphes chinensis* Chamberlin, Chinese lepidosaphes scale.

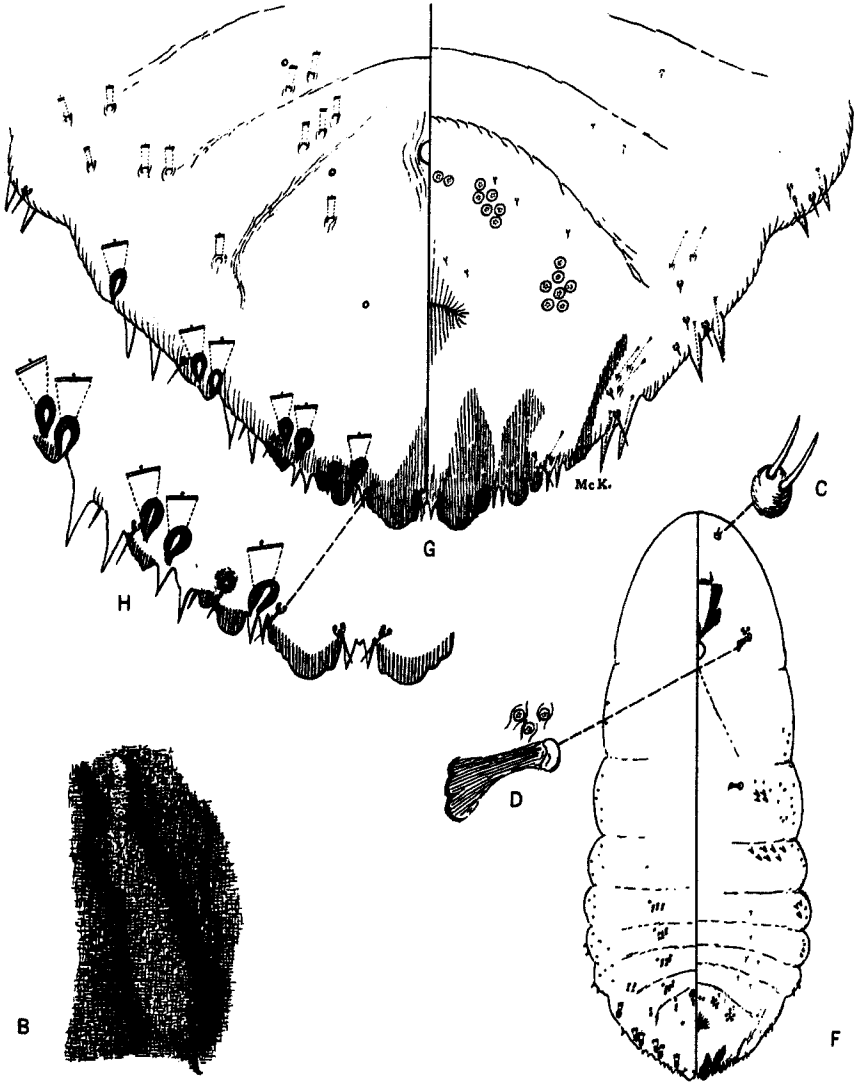

Fig. 85. *Lepidosaphes destefanii* Leonardi, De Stefan scale.

Additional hosts: *Olea europaea,* olive.
Discussion:

This species is included within a complex group of forms closely related to *Lepidosaphes ficus* (Signoret). The species is apparently confined to Sonoma County, the present infestations extending from an area one-half mile south of Cloverdale to approximately five miles south of that city on the Italian Swiss Colony property at Asti. Another infestation occurs in an old abandoned olive orchard on a hillside one-fourth mile west of Highway 101 at Geyserville, which is three miles farther south.
California records:

Sonoma Co.: Asti, IV-14-52 (R. P. Allen). Cloverdale, IV-3-52 (L. J. Garrett and R. P. Allen). Geyserville, IV-17-52 (R. P. Allen, H. T. Osborn, and L. J. Garrett).

Lepidosaphes ficus (Signoret)
Fig scale
(Figs. 86 and 87)

Mytilaspis ficus Signoret, 1870, Ann. Soc. ent. Fr., 4(10):94.
Mytilaspis ficifoli Berlese, 1903, Atti Ist. Incorragiamento, 5(5), illus.
Mytilococcus ficifoliae (Berlese), Lupo, 1943, Boll. Lab. ent. Portici, 5:186-205, illus.
Lepidosaphes ficifoliae (Berlese), Ferris, 1937, Atlas of Scale Insects, Ser. I:73.
Lepidosaphes ficus (Signoret), Ferris, 1938, Atlas of Scale Insects, Ser. II:144.
Lepidosaphes ficus (Signoret), Stafford and Barnes, 1948, Hilgardia 18(16).
Type locality: Cannes, France.
Type host: *Ficus,* cultivated fig..
Relation to host: Occurring on the twigs in the winter time and as a dimorphic form on the leaves during early and midsummer. Adult female scale on twigs elongate, moderately slender, dark brown, the usual lepidosaphine type, with exuviae at one end. Adult female scale on leaves elongate, brownish, appearing distorted presumably as a result of pressure of surrounding leaf hairs, having a jointed appearance; male scale similar in shape and color to that of adult female only much smaller.
Additional hosts: Taken also from *Juglans* and *Ulmus.*
Discussion:

For many years this species and *Lepidosaphes ficifoliae* (Berlese) were considered distinct species—and for a good reason since morphological details exhibited on the pygidium were quite different in the two forms. However, it has since been proven by Lupo (1943) and later confirmed by Stafford and Barnes (1948) that *ficifoliae* is a dimorphic summer form of *ficus.* A detailed drawing of *ficus* (fig. 84) and its dimorphic form (fig. 85), is here presented.
California records:

Fresno Co.: Fresno, X-13-38 (H. H. Keifer). Kingsburg, XI-15-40 (O. L. Hemphill). Sanger, X-4-39 (T. B. Gallion).

Glenn Co.: Orland, VIII-28-47 (E. Otis).

Kern Co.: Bakersfield, X-29-52 (C. M. Finnell).

Kings Co.: Hanford, VIII-31-48 (R. P. Allen). Lemoore, IX-1-48 (R. P. Allen).

Madera Co.: Madera, III-6-42 (G. Beevor).

Orange Co.: Buena Park, XI-17-52 (D. H. Byers). Cypress, III-6-53 (D. H. Byers). Fullerton, III-12-52 (A. Johnson and D. H. Byers).

San Diego Co.: Paradise Valley, XII-24-41 (D. F. Palmer). Vista, II-18-53 (G. W. Schwegel and C. R. Tower).

San Joaquin Co.: Stockton, II-14-40 (J. W. Dixon).

Santa Clara Co.: San Jose, VII-1939 (A. M. Foster).

Tulare Co.: Dinuba, XI-24-39 (Lackland). Visalia, V-5-49 (O. L. Hemphill).

Lepidosaphes gloverii (Packard)
Glover scale
(Fig. 88)

Coccus gloverii Packard, 1869, Guide to Study of Insects, 1:527.
Aspidiotus gloverii (Packard) 1870, 7th Rep. Mass. Bd. Agric., (1869), p. 259.
Mytilaspis gloverii (Packard). Comstock, 1881, Rep. U.S.D.A. for 1880, p. 323.
Mytilella sexspina Hoke, 1922, Ann. Ent. Soc. Amer., 14:341, illus.
Lepidosaphes gloverii (Packard). Ferris, 1937, Atlas of Scale Insects, Ser. I:74.
Type locality: Florida.
Type host: *Citrus.*
Relation to host: Occurring on the bark, leaves, and fruit. Adult female scale slender, elongate, brownish, exuviae at one end; male scale similar to adult female in color, exuvia terminal.
Additional hosts: *Euonymus, Magnolia,* palms, *Salix,* and *Sciadopitys verticillata.*
Discussion:

The adult female scale of this species has the dorsum of the thoracic region and the first abdominal segment heavily sclerotized, the intersegmental lines remaining membranous. Also abdominal segments 2-4 with rather well-developed

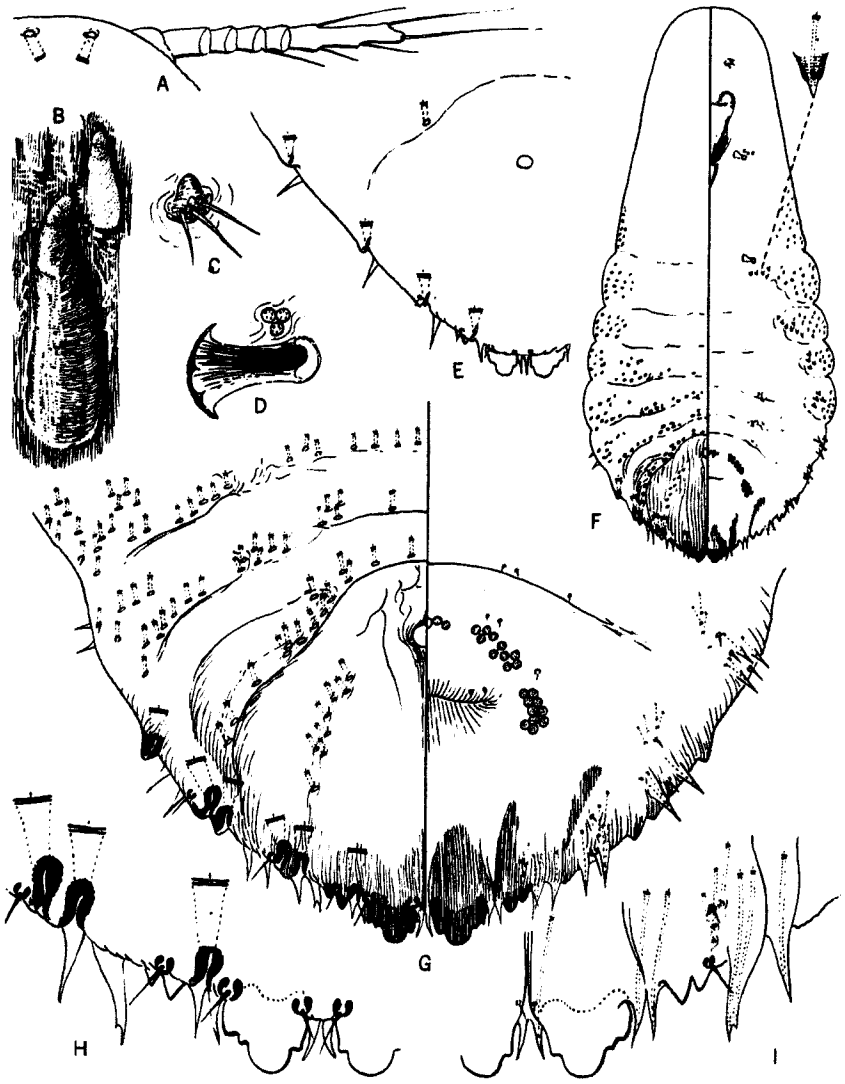

Fig. 86. *Lepidosaphes ficus* (Signoret), fig scale.

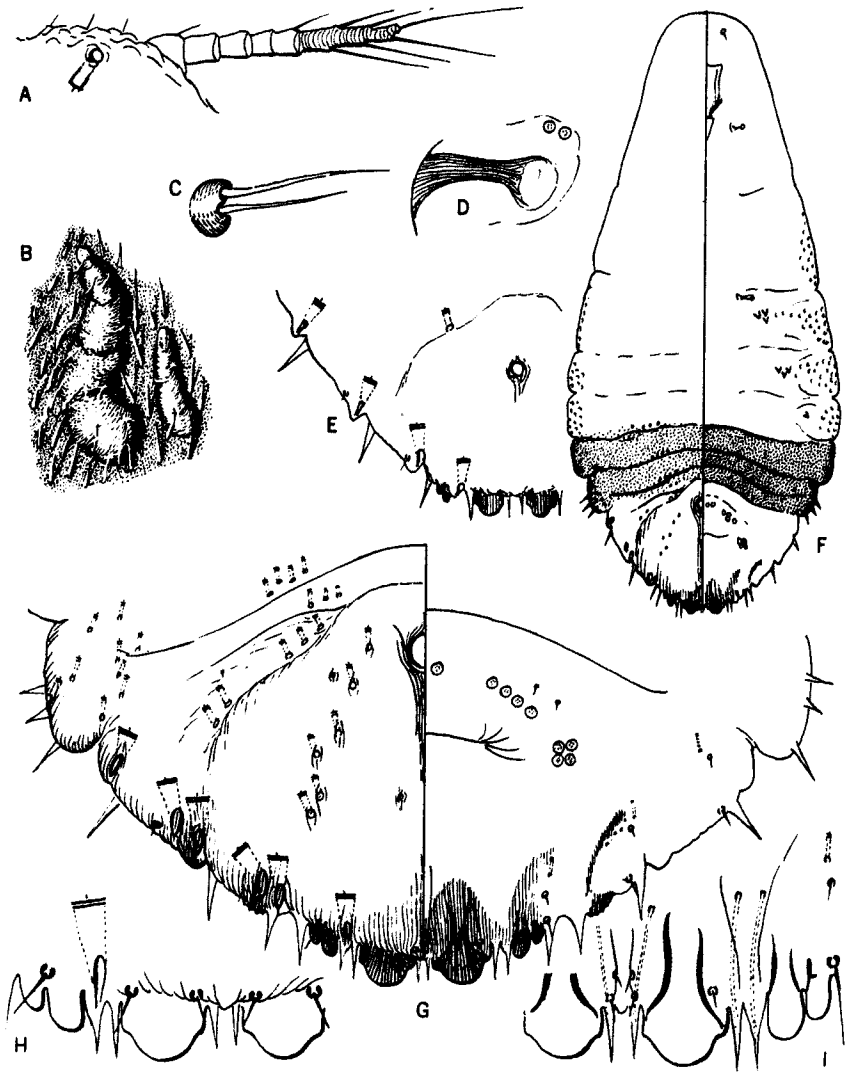

Fig. 87. *Lepidosaphes ficus* (Signoret), fig. scale, dimorphic form.

lateral lobes, each of which has a distinct sclerotized, small, sharp, marginal thornlike spur. These characters serve to identify the species.

California records:

Alameda Co.: Oakland, XI-2-32 (B. B. Whitney and F. J. March).

Los Angeles Co.: Los Angeles, V-28-32 (Smoyer).

Orange Co.: Capistrano, III-16-34 (D. W. Tubbs).

San Diego Co.: Paradise Valley, XII-24-41 (D. F. Palmer).

Lepidosaphes machili (Maskell)
Cymbidium scale
(Fig. 89)

Mytilaspis machili Maskell, 1898, Trans. N.Z. Inst., 30:230.

Aspidiotus pomorum Bouché, 1851, Stettin. ent. Ztg., 12:110 (according to Ferris, 1942, in part as a misidentification by Kuwana in 1901).

Lepidosaphes piniformis (Bouché), 1851, Stettin. ent. Ztg., 12:111 (according to Ferris, 1942, as a misidentification combined with disregard of the rules of nomenclature by Lindinger in 1934).

Lepidosaphes tuberculata Malenotti, 1916, Redia, 12:183, illus.

Lepidosaphes cymbidicola Kuwana, 1925. Imp. Plant Quaran. Serv., Tech. Bull. 2:27, illus.

Lepidosaphes machili (Maskell), Ferris, 1942, Atlas of Scale Insects, Ser. IV:397.

Type locality: Japan.

Type host: *Machilus thunbergii.*

Relation to host: Occurring on the stems (leads) and leaves of orchids. Adult female scale elongate, dark brown, exuviae terminal; male scale smaller, narrow elongate, of the same color as that of the adult female, exuvium at one end.

Additional hosts: *Cinnamomum* spp., *Cycas, Cymbidium* spp., *Tetradymia glauca,* and many orchid genera.

Discussion:

This species of *Lepidosaphes* may be immediately recognized from other members of the genus by the ocular spines on the prosoma. Severe infestations of this scale are often found, principally on orchids, in California nurseries.

California records:

Alameda Co.: Berkeley, VI-1-36 (G. B. Laing).

Los Angeles Co.: Altadena, IV-28-41. Arcadia, XI-7-40. San Gabriel, VI-27-40. Santa Monica, VIII-29-40. West Los Angeles, VI-19-41 (J. B. Steinweden).

Orange Co.: Orange, XII-5-46 (J. Walden and J. B. Steinweden). Santa Ana, VI-6-46 (J. B. Walden).

Riverside Co.: Riverside, V-17-47 (F. R. Platt).

San Diego Co.: San Diego, X-9-47 (D. F. Palmer).

San Mateo Co.: Colma, V-7-43 (C. Sill).

Santa Barbara Co.: Santa Barbara, IX-12-44 (C. E. Ehman and R. P. Allen).

Ventura Co.: Ventura, I-27-48 (Holmer and Bricker).

Lepidosaphes mackieana McKenzie
Mackie scale
(Fig. 90)

Lepidosaphes mackieana McKenzie, 1943, Calif. Dept. Agric. Bull., 32(2):153-155, illus.

Type locality: West Los Angeles, Los Angeles County, California.

Type host: *Dendrobium merlini,* orchid.

Relation to host: Occurring under the sheath on leads just above plant crown. Adult female scale narrow elongate, pale brown, exuviae terminal; male scale narrow elongate, resembling the adult female in color except possibly somewhat lighter, exuvium terminal.

Additional hosts: Recorded only on *Dendrobium* spp., orchids.

Discussion:

This species specifically attacks *Dendrobium* orchids grown in nursery environment. It is closely related to *Lepidosaphes noxia* McKenzie but differs in having the median lobes laterally serrate whereas in *noxia* these lobes are only slightly once-notched on each side.

California records:

Los Angeles Co.: Hawthorne, IV-21-42 (F. R. Platt and V. E. Daniels). West Los Angeles, VIII-20-42 (C. R. Tower, E. L. Myers, and H. L. McKenzie).

Lepidosaphes maskelli (Cockerell)
Maskell scale
(Fig. 91)

Mytilaspis pallida variety *maskelli* Cockerell, 1897, Amer. Nat., 31:704.

Lepidosaphes newsteadi (Sulc), Ferris, 1938, Atlas of Scale Insects, Ser. II:136 (misidentification).

Lepidosaphes pallida (Maskell), Zimmerman, 1948. Insects of Hawaii, 5:422-426 (misidentification).

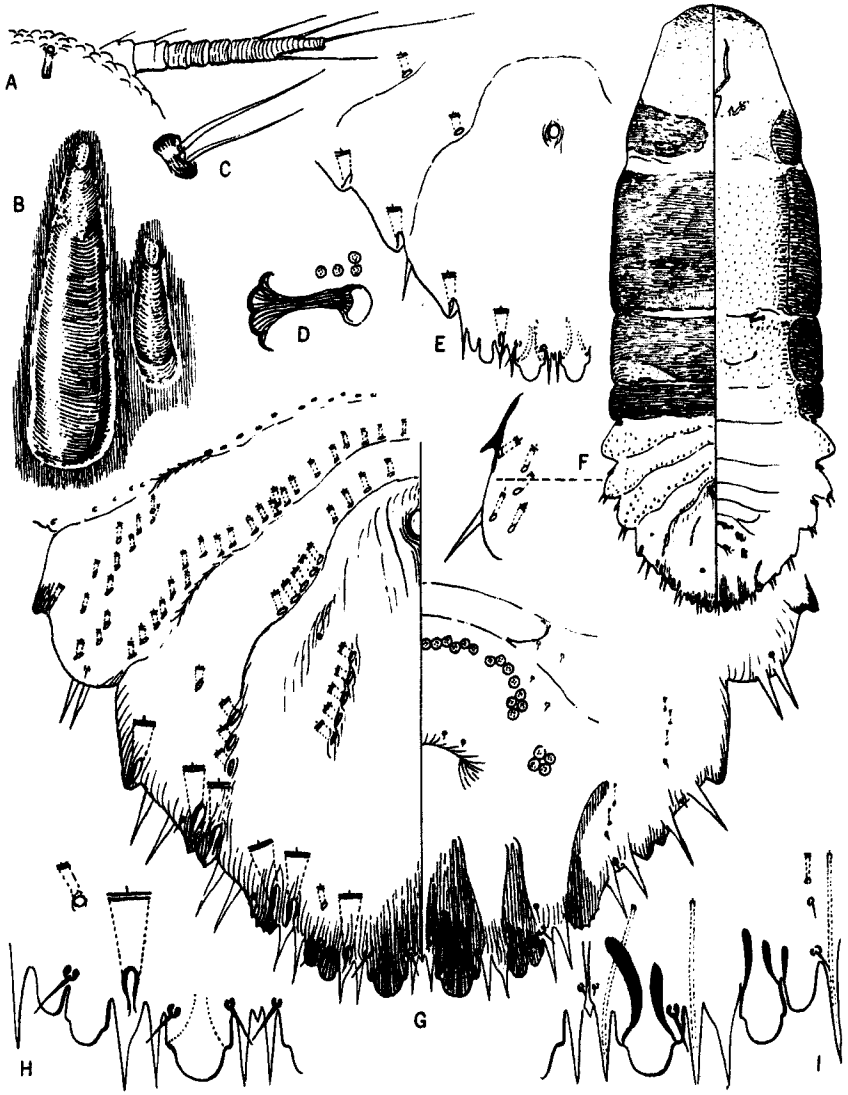

Fig. 88. *Lepidosaphes gloverii* (Packard), glover scale.

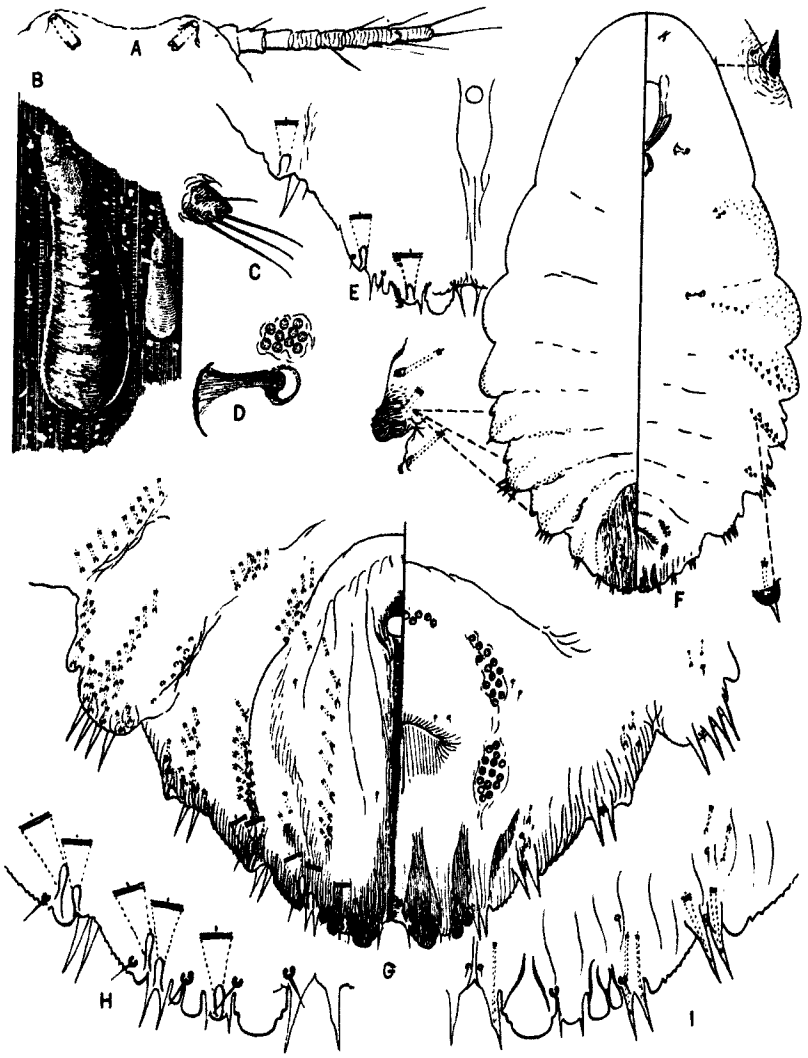

Fig. 89. *Lepidosaphes machili* (Maskell), cymbidium scale.

Lepidosaphes maskelli Cockerell, Balachowsky, 1954, Les Cochenilles Palearctiques de la Tribu des Diaspidini, Mem. Sci. Inst. Past., pp. 87-91, illus.

Type locality: Hawaiian Islands, from Japan.

Type host: *Podocarpus,* conifer.

Relation to host: Occurring on the needles. Adult female scale quite slender, elongate, pale brown, exuviae terminal; male scale elongate, of the same color as adult female, exuvium at one end.

Additional hosts: *Cephalotaxus, Cryptomeria japonica, Juniperus, Picea, Sciadopitys verticillata, Sequoia sempervirens,* and other conifers.

Discussion:

Balachowsky (1954) has indicated that *Lepidosaphes maskelli* (Cockerell) is very closely related to two other coniferous infesting species, *Lepidosaphes newsteadi* (Sulc) and *Lepidosaphes juniperi* Lindinger, differing chiefly in the presence of a single (occasionally 2) submarginal dorsal pygidial macroduct on the fifth abdominal segment as compared to 3 or 4 in the other species. The last two named species of *Lepidosaphes* are not found in California.

In correspondence of December 15, 1949, Dr. Harold Morrison, Coccidologist of the United States Department of Agriculture, pointed out the apparent confusion which has existed regarding the identity of the *Lepidosaphes* species infesting coniferous hosts in North America, and after his review stated: "I have no reason to believe that *Lepidosaphes newsteadi* is present in this country and expect that all records of this, including that by Ferris (Atlas II:146), will ultimately be assigned elsewhere."

An infestation of *Lepidosaphes maskelli* (Cockerell) infesting *Sciadopitys verticillata* in the Huntington Gardens, San Marino, Los Angeles County, has persisted since 1935 in spite of repeated attempts to control it by spraying. This species is intermixed with *Lepidosaphes sciadopitysi* McKenzie. Both species are indistinguishable externally on the needles. Microscopically, however, *maskelli* differs from *sciadopitysi* chiefly in the absence of three sets of lateral abdominal spurs, these present in *sciadopitysi,* and a one-spined antenna as compared to a two-spined in *sciadopitysi.*

California records:

Los Angeles Co.: Compton, IV-17-35 (L. E. Myers). Hawthorne, I-14-42. Los Angeles, IV-3-39 (L. E. Myers). San Marino, X-25-49 (R. W. Harper).

San Diego Co.: Encinitas, II-5-46 (C. E. Ehmann).

Santa Clara Co.: Palo Alto.

Lepidosaphes noxia McKenzie
Noxius scale
(Fig. 92)

Lepidosaphes noxia McKenzie, 1946, Proc. Hawaii. Ent. Soc., 12(3):611-613, illus.

Type locality: San Leandro, Alameda County, California.

Type host: *Dendrobium deari,* orchid.

Relation to host: Scale insects occurring on the leads of orchids, concentrating particularly where the leaf partly surrounds the lead. Adult female scale elongate, pale brown, exuviae terminal; male scale smaller, much lighter in color than female, exuvium at one end.

Additional hosts: Known only from orchid plants of the *Dendrobium* group.

Discussion:

This species is closely related to *Lepidosaphes mackieana* McKenzie, but differs in the character of the median lobes which are only slightly once-notched on each side, whereas in *mackieana* they are laterally serrate.

California record:

Alameda Co.: San Leandro, II-9-44 (M. R. Bell).

Lepidosaphes sciadopitysi McKenzie
Umbrella pine Lepidosaphes
(Fig. 93)

Lepidosaphes sciadopitysi McKenzie, 1955, Pan-Pacific Ent. 31(4):187-190, illus.

Type locality: San Marino, Los Angeles County, California.

Type host: *Sciadopitys verticillata,* umbrella pine.

Relation to host: Occurring on the needles. Adult female scale quite slender, averaging approximately 1.40 mm. long, brownish, exuviae terminal; male scale smaller, similar in color to that of adult female, exuvium terminal.

Additional hosts: Recorded only on umbrella pine, *Sciadopitys verticillata.*

Discussion:

In California *Lepidosaphes sciadopitysi* McKenzie is found intermixed with *L. maskelli* (Cockerell) on the needles of umbrella pine in the Huntington Gardens, San Marino, Los Angeles County. This is the only known infestation of *L. sciadopitysi* in the state. The scale has persisted for years in spite of repeated attempts to control it by spraying.

Both *Lepidosaphes sciadopitysi* and *L. maskelli* are indistinguishable externally on the needles. Morphologically, on microscope slides, however,

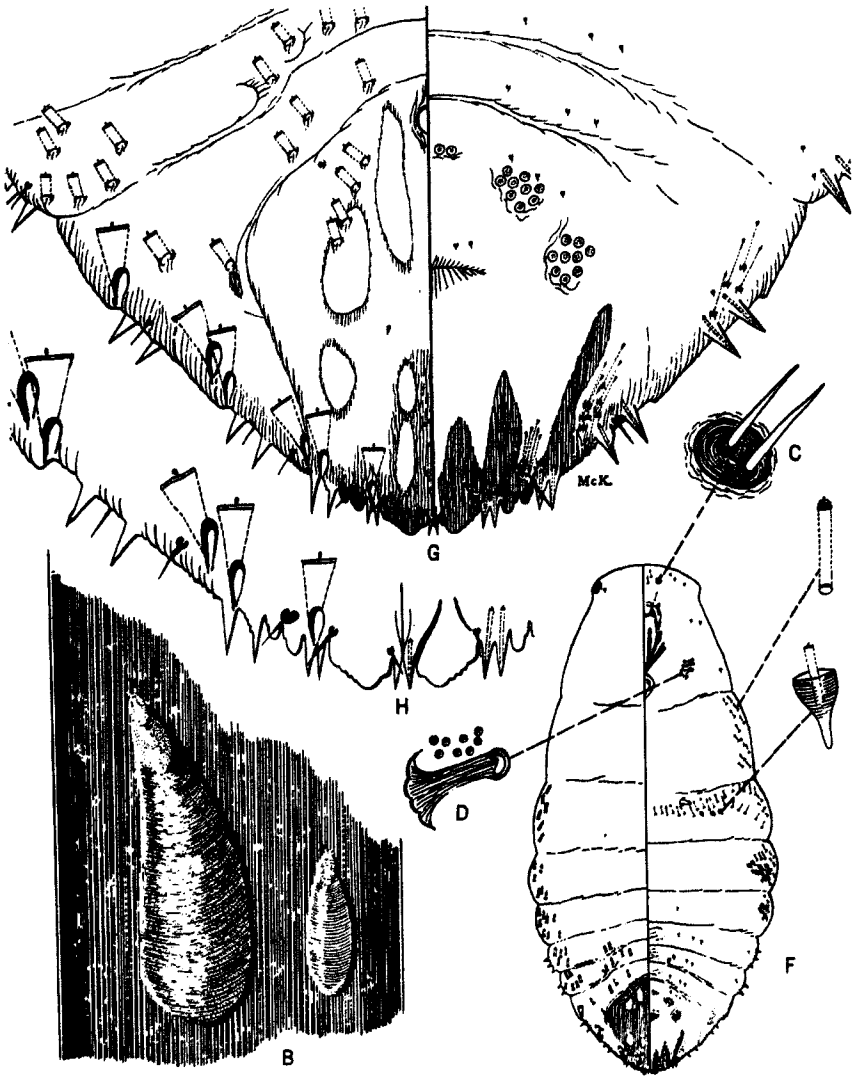

Fig. 90. *Lepidosaphes mackieana* McKenzie, Mackie scale.

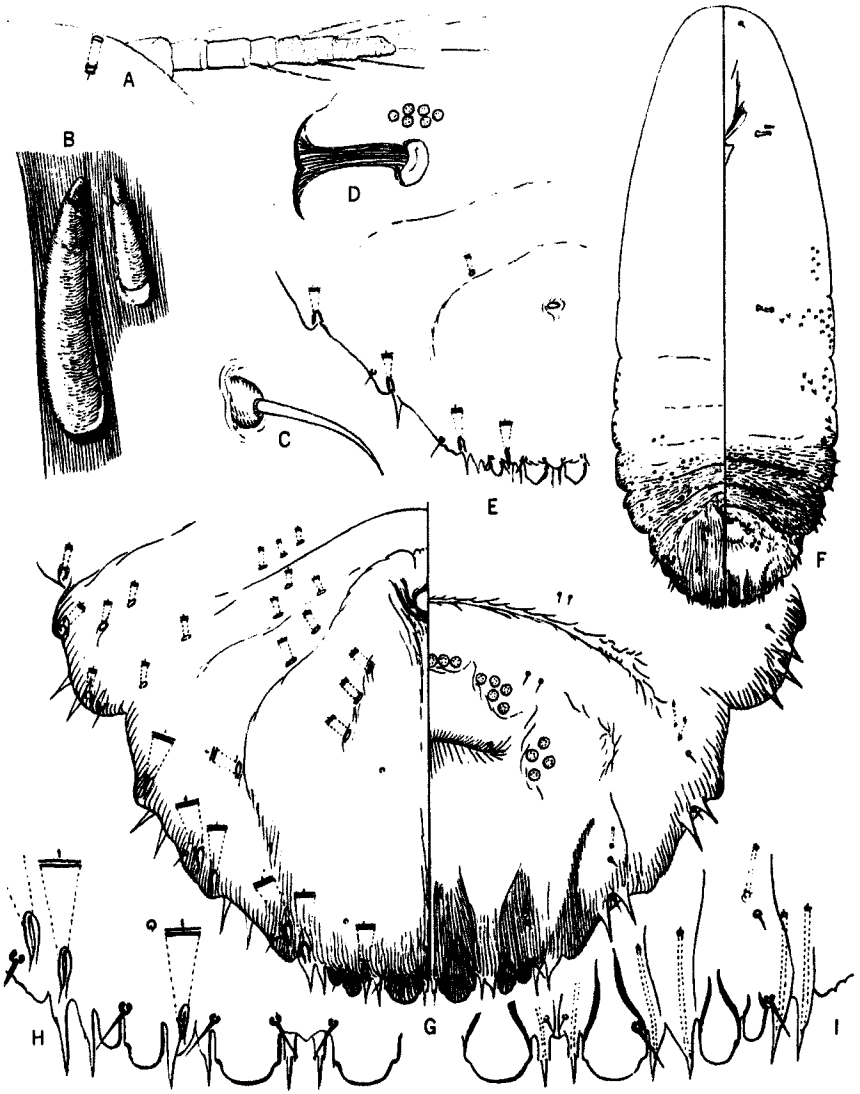

Fig. 91. *Lepidosaphes maskelli* (Cockerell), Maskell scale.

L. sciadopitysi differs from *L. maskelli* chiefly in the presence of three sets of lateral abdominal spurs, these lacking in *maskelli*, and a two-spined antenna as compared to only one-spined in *maskelli*.

California record:

Los Angeles Co.: San Marino, X-25-49 (R. W. Harper).

Lepidosaphes tokionis (Kuwana)
Croton scale
(Fig. 94)

Mytilaspis newsteadi variety *tokionis* Kuwana, 1902, Proc. Calif. Acad. Sci., 3(3):81.

Mytilaspis auriculata Green, 1907, Trans. Linn. Soc. Lond. Zool. 12(2):5, illus.

Lepidosaphes lasianthi (Green), Ferris, 1938, Atlas of Scale Insects, Ser. II:145 (misidentification).

Lepidosaphes tokionis (Kuwana), Ferris, 1942, Atlas of Scale Insects, Ser. IV:398.

Type locality: Tokyo, Japan.

Type host: *Codiaeum* spp.

Relation to host: Occurring on the leaves. Adult female scale elongate, narrow pale brown, exuviae terminal; except for its smaller size the male scale is of the same shape and color as that of the adult female, exuvium at one end.

Additional hosts: *Codiaeum variegatum*, croton.

Discussion:

This species is recognizable by the development of cephalic lobes on the anterior prosoma and by the acute median pygidial lobes which are serrate on mesal margin.

California records:

Alameda Co.: Oakland, IV-22-47 (S. M. Mather). San Lorenzo, I-2-52.

Los Angeles Co.: Los Angeles, VIII-26-53 (B. W. Kemper).

San Mateo Co.: Menlo Park, I-25-51 (B. E. Edwards).

Lepidosaphes ulmi (Linnaeus)
Oystershell scale
(Pl. 3, middle row, center; fig. 95)

Coccus ulmi Linnaeus, 1758, System. Nat., 10th ed. 1:455.

Aspidiotus pomorum Bouché, 1851, Stettin. ent. Ztg., 12:110.

Lepidosaphes ulmi (Linnaeus), Ferris, 1937, Atlas of Scale Insects, Ser. I:76.

Ferris (1937) states the following: "The synonymy of this species is much confused, certain of the names which are placed under it in the Fernald Catalogue having later been revived by European authors or placed as synonyms of other species. About all that can be said definitely at present is that it is the species which is commonly accepted as having been the *Coccus ulmi* of Linnaeus, the *Aspidiotus pomorum* of Bouché, which became the *Mytilaspis pomorum* (Bouché) of Signoret and later authors."

Type locality: Europe.

Type host: *Ulmus carpinifolia* (elm).

Relation to host: Occurring either on bark or leaves. Adult female scale elongate slender, rather variable in form, being curved or straight to conform with the surface of its host and conditions of crowding, gray to purplish, exuviae at one end; no male scale present, the species apparently being parthenogenetic.

Additional hosts: The list of hosts on which this species has been reported is long, and it may occur upon almost anything except conifers. Ferris (1937) records it from the leaves of cultivated bean. A few other hosts include: *Araujia, Buxus* sp., butternut, *Ceanothus, Cotoneaster, Crataegus, Eriogonum parvifolium, Genista, Gladiolus, Ilex aquifolium, Juglans cinerea, Juglans* spp., *Olea europaea, Photinia (Heteromeles) arbutifolia, Populus, Prunus amygdalus, Prunus emarginata, Prunus* spp., *Pyrus, Ribes, Salix,* and *Syringa* spp.

Discussion:

This species is perhaps most easily confused with *Lepidosaphes beckii* (Newman) being distinguished from it by possessing lateral spurs on the abdominal segments which are entirely lacking in *beckii*.

The suggestion has been made that there are two forms of this species in North America, one occurring on lilac and the other on willow and other hosts. At the moment no differences have been noted which would merit nomenclatorial recognition.

California records:

This species is widely distributed throughout California. A few of the specific localities from widely separated areas are here listed:

Alameda Co.: Albany, IX-11-41 (M. R. Bell). Berkeley, IX-25-41 (M. R. Bell). Hayward, X-6-41 (M. R. Bell).

Alpine Co.: Woodfords, IX-14-41 (E. A. Breech).

Amador Co.: Silver Lake, VII-24-40 (G. Beevor).

Butte Co.: Chico, I-14-52 (L. Hosbrook). Paradise, I-20-42 (L. Kartman).

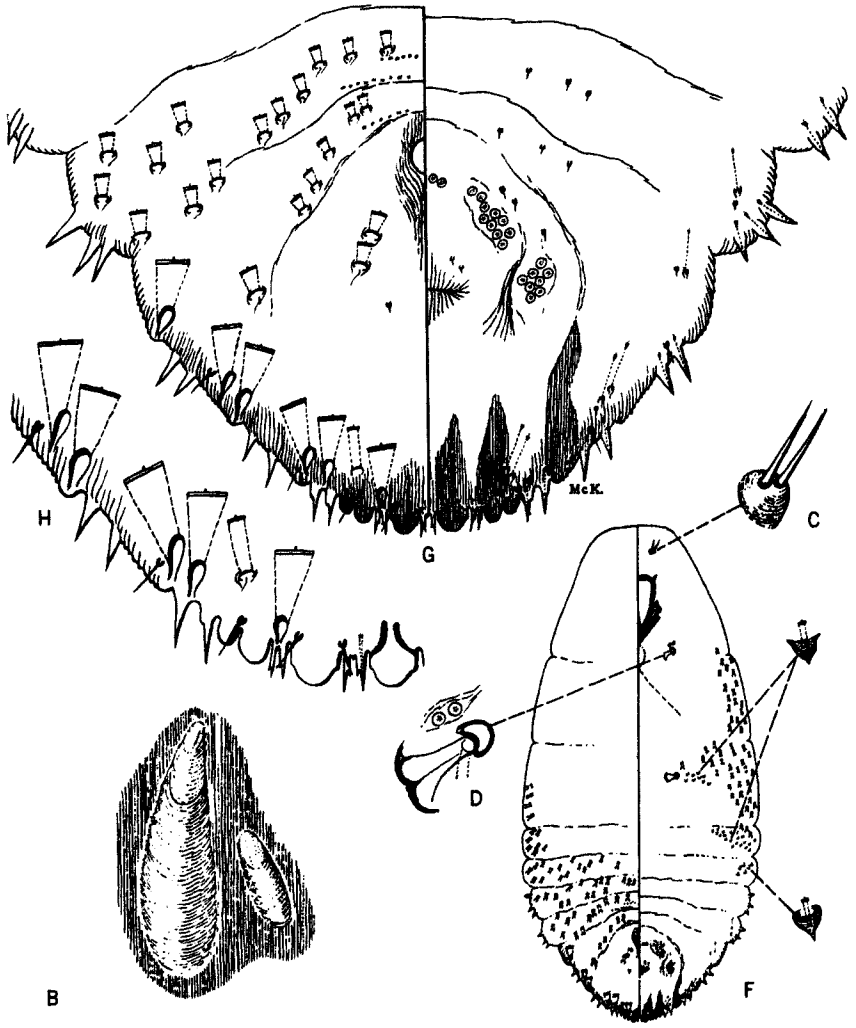

Fig. 92. *Lepidosaphes noxia* McKenzie, noxius scale.

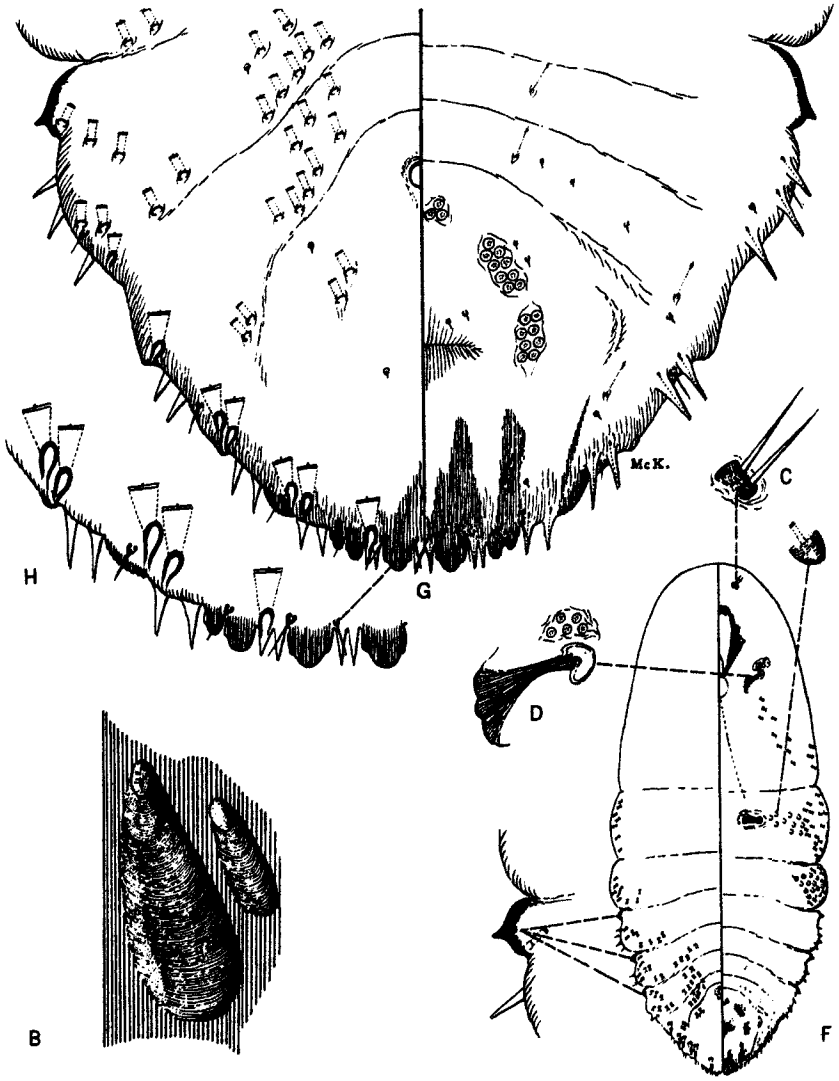

Fig. 93. *Lepidosaphes sciadopitysi* McKenzie, umbrella pine lepidosaphes.

Contra Costa Co.: San Pablo, V-20-44 (H. T. Osborn and F. M. Semans).

El Dorado Co.: Kyburz, IX-5-38 (S. S. Smith). Placerville, IV-6-41 (F. Herbert). Salmon Falls, IX-8-28 (M. L. Jones).

Fresno Co.: Fresno, X-5-42 (J. W. Dixon). Sanger, I-27-43 (J. W. Dixon).

Lake Co.: Calistoga, V-2-39 (Brandt).

Los Angeles Co.: Glendale, VII-7-41. Los Angeles, III-24-41.

Mendocino Co.: Navarro, X-28-43 (Gray and Hess).

Merced Co.: Le Grand, III-30-48 (T. D. Southward). Merced, VII-20-29.

Modoc Co.: Alturas, VII-6-49 (H. T. Osborn).

Monterey Co.: Prunedale, XI-23-43 (Cameron and Ramsay). Soledad, IV-13-54 (R. P. Allen and R. V. Emparan).

Napa Co.: Napa, IV-25-52 (R. P. Allen).

Nevada Co.: Nevada City, III-3-36 (M. Bellue). Peavine, IV-30-48 (H. M. Armitage).

Placer Co.: Emigrant Gap, IX-9-38 (S. S. Smith). Folsom, VI-11-41 (H. W. Marshall).

Sacramento Co.: Sacramento, VII-23-36 (E. L. Stanley).

San Diego Co.: San Diego, III-13-47 (K. H. Baker).

San Joaquin Co.: Stockton, X-28-43 (Griswold).

San Mateo Co.: Half Moon Bay, XI-12-43 (Gray and Hess). Menlo Park, IV-1-52 (B. E. Edwards).

Santa Barbara Co.: Santa Barbara, IX-15-39 (C. R. Tower).

Santa Clara Co.: San Jose, VII-8-36 (L. R. Cody). Stanford University X-23-35 (L. E. Myers).

Santa Cruz Co.: Aptos, VII-28-41 (M. R. Bell). Watsonville, IX-30-47 (R. W. Cogswell).

Siskiyou Co.: Scott's Valley, VII-26-39 (S. L. Lockwood).

Solano Co.: Dixon, V-14-40 (H. W. Marshall). Vallejo, X-8-52 (L. A. Black).

Sonoma Co.: Santa Rosa, XI-6-41 (O. E. Bremner). Sonoma, I-8-48 (T. B. Gallion).

Stanislaus Co.: Modesto, VII-14-36 (M. M. Schrock).

Tehama Co.: Vina, XII-8-41 (Newsom).

Tulare Co.: I-11-44 (J. W. Dixon).

Ventura Co.: Cullignas Creek, IX-3-42 (Travis). Santa Paula, IX-18-41 (L. R. Gillogly).

Yolo Co.: Davis, III-7-47 (E. T. Gammon). Little Holland, XII-31-38 (E. E. Fix).

Leucaspis cockerelli (de Charmoy)
Cockerell scale
(Fig. 96)

Fiorinia cockerelli de Charmoy, 1899. Proceedings of the Societé Amicale Scientifique de Mauritius, p. 33.

Leucodiaspis cockerelli (de Charmoy), Lindinger, 1908, Jahrb. hamburg, wiss. Anst., 25:121.

Leucaspis cockerelli (de Charmoy), Ferris, 1941, Atlas of Scale Insects, Ser. III:289.

Leucodiaspis cockerelli (de Charmoy), Zimmerman, 1948, Insects of Hawaii, 5:374-376, illus.

Type locality: Maritius.

Type host: *Citrus.*

Relation to host: Occurring on the leaves or petioles. Adult female scale slender and elongate, composed mainly of the greatly elongated, sclerotized second exuvia which is covered by a thin film of wax, brownish, although wax film may make it appear whitish; male scale not observed.

Additional hosts: *Bactris* sp., *Cattleyia* sp., *Chamaedorea, Chrysalidocarpus lutescens, Dendrobium, Dracaena,* palms, *Eupritchardia grandis,* and *Smilax.* The fact that these hosts are monocots would suggest an error in the citation of the original host.

Discussion:

This scale was found in a California nursery. The species is rather closely related to *Leucaspis japonica* Cockerell, differing in shape of pygidial lobes and plates.

California records:

San Mateo Co.: Colma, VII-8-53 (C. W. Bridges and C. M. Sill).

Leucaspis portaeaureae Ferris
Podocarpus leucaspis scale
(Fig. 97)

Leucaspis portaeaureae Ferris, 1942, Atlas of Scale Insects, Ser. IV:399.

Type locality: San Francisco, California (originally from New Zealand).

Type host: *Podocarpus acutifolia.*

Relation to host: Occurring on the needles. Adult female scale slender and elongate, composed of a heavily sclerotized second exuvia and an

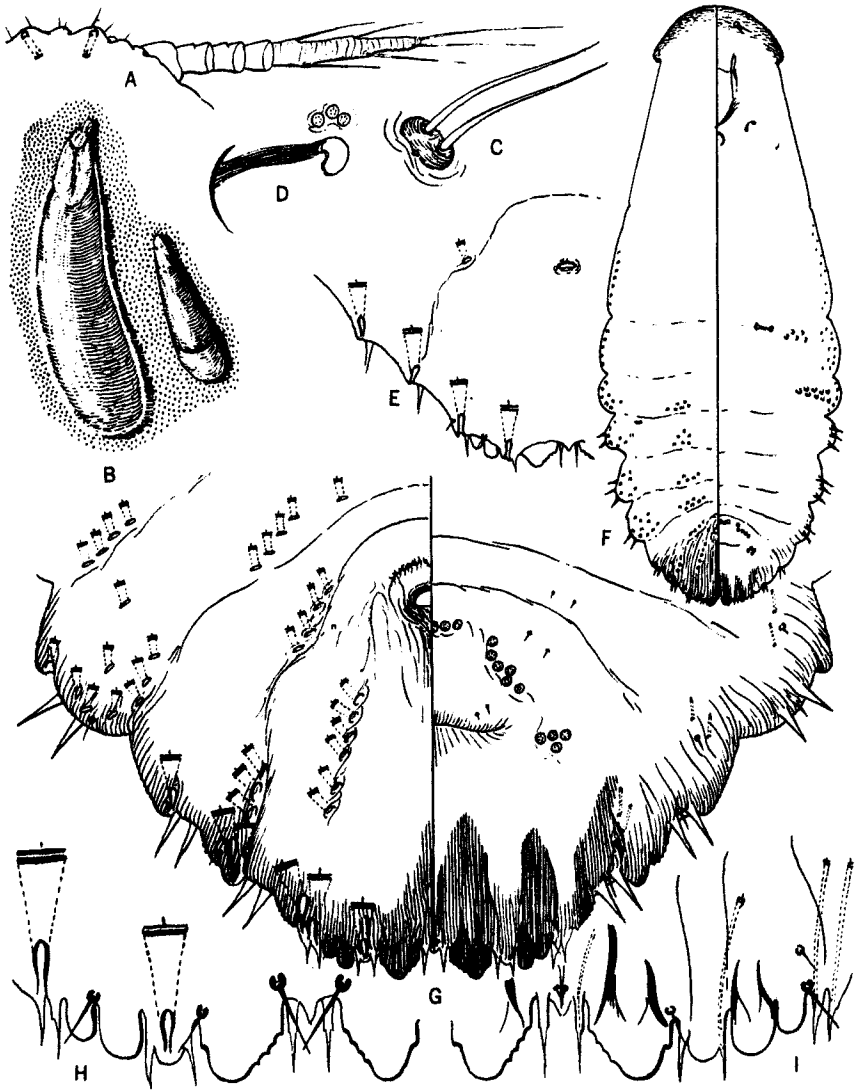

Fig. 94. *Lepidosaphes tokionis* (Kuwana), croton scale.

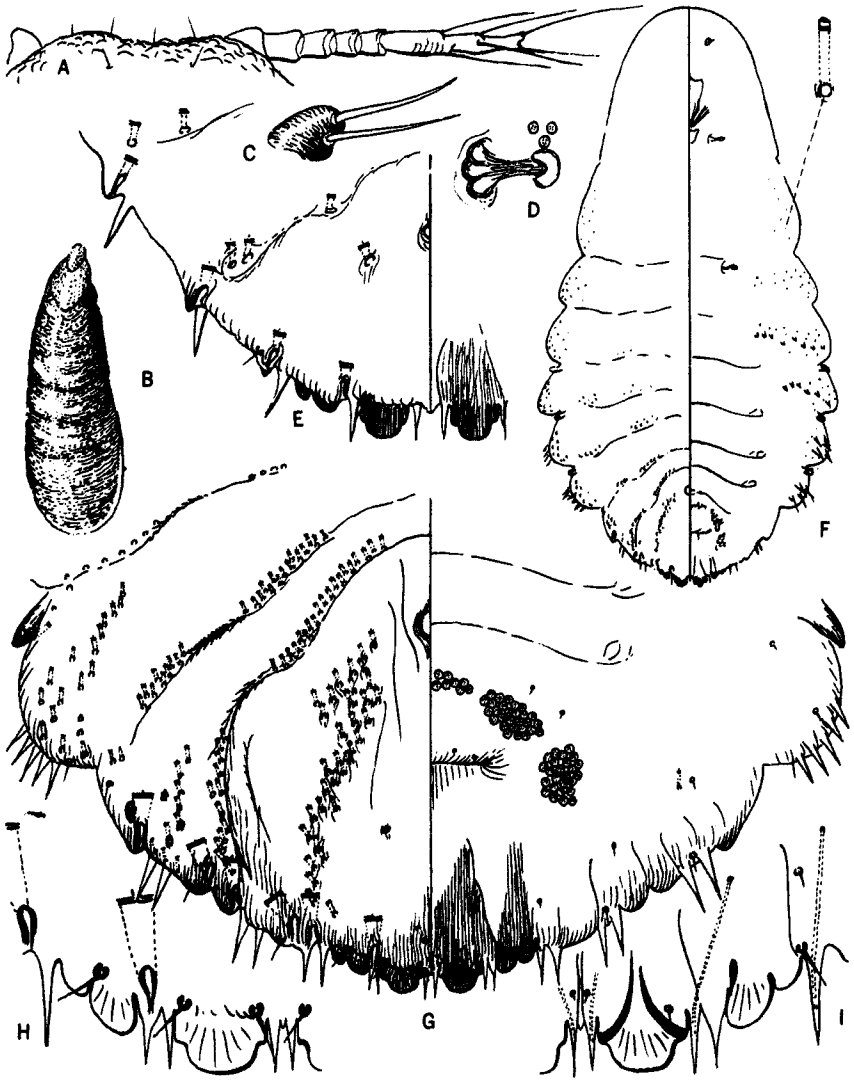

Fig. 95. *Lepidosaphes ulmi* (Linnaeus), oystershell scale.

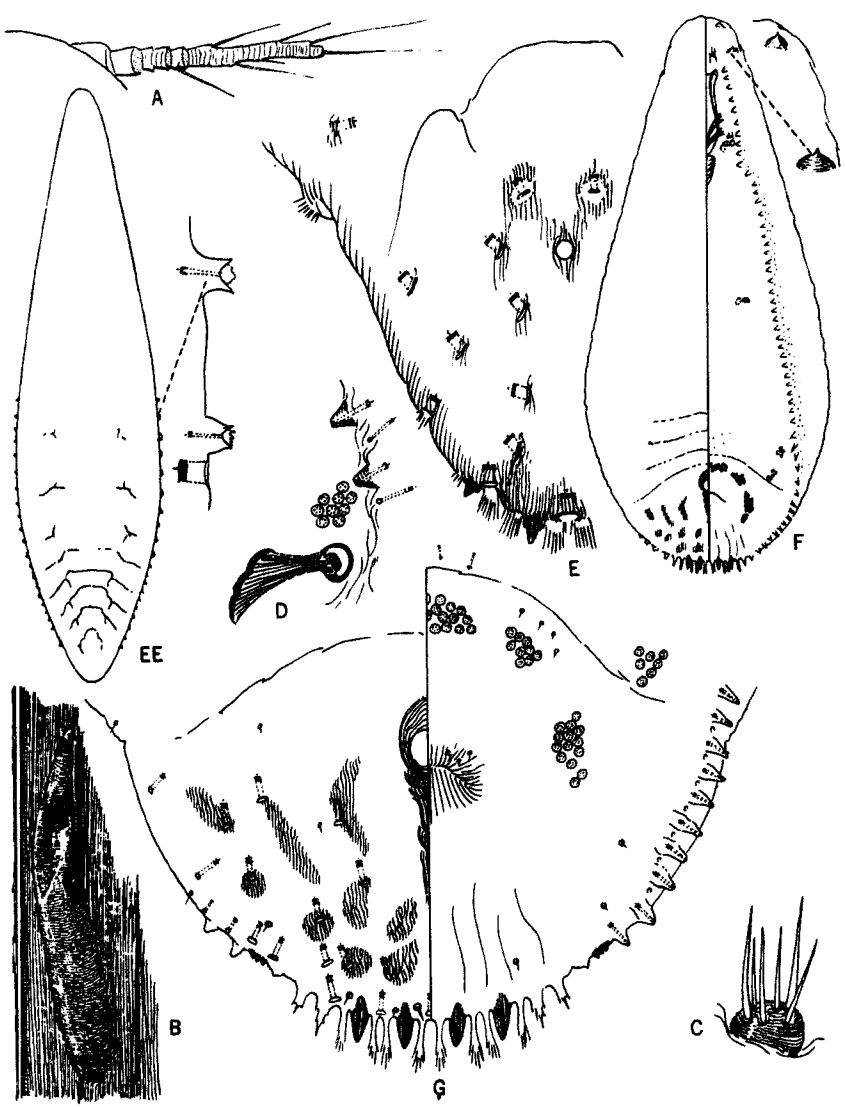

Fig. 96. *Leucaspis cockerelli* (de Charmoy), Cockerell scale.

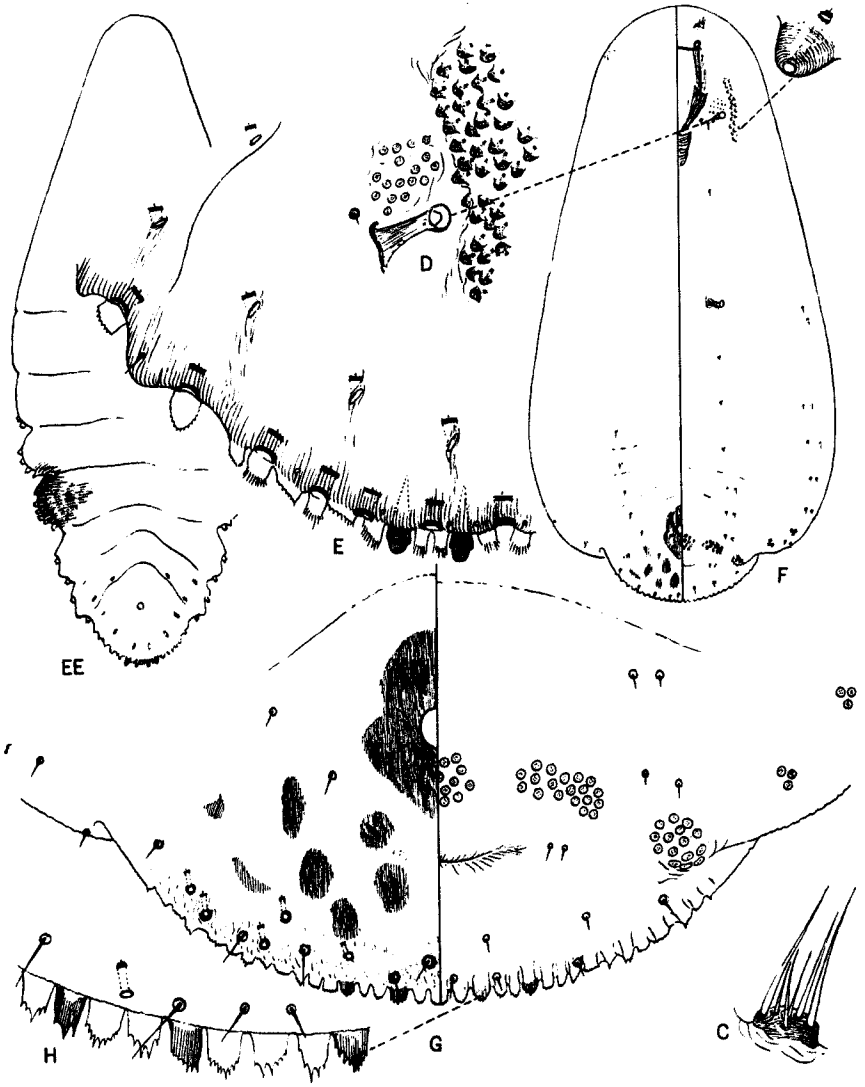

Fig. 97. *Leucaspis portaeaureae* Ferris, Podocarpus leucaspis scale.

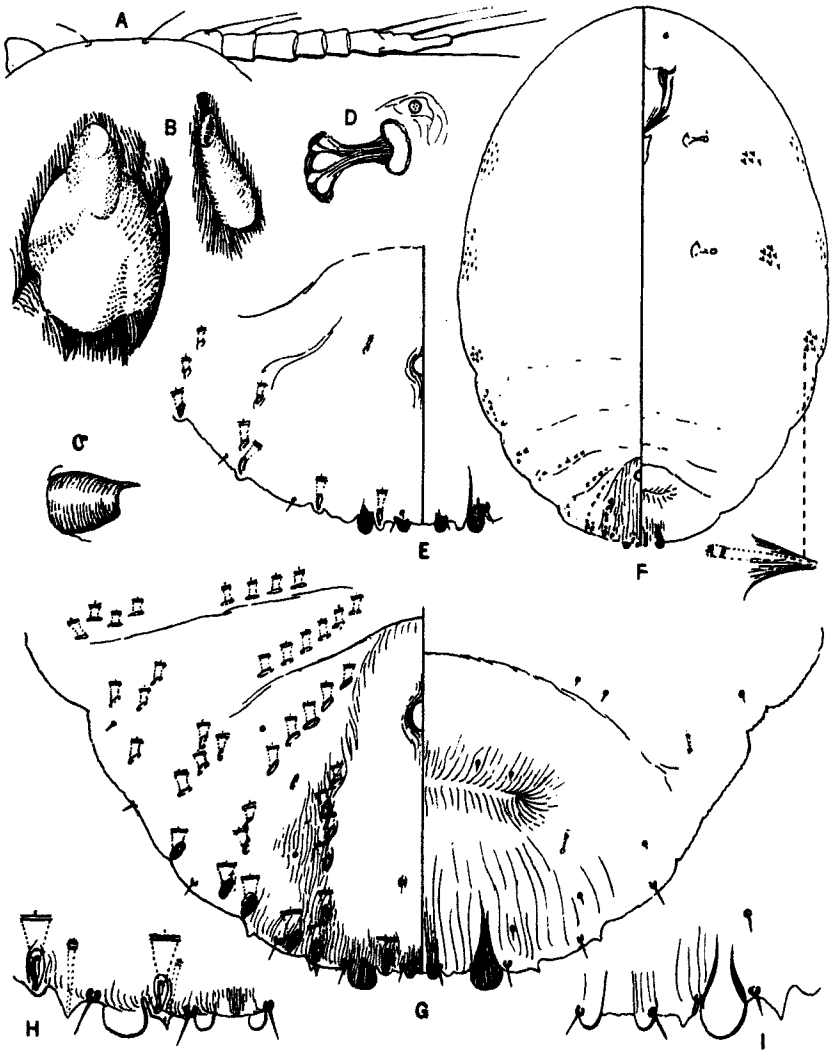

Fig. 98. *Lineaspis cupressi* (Coleman), California lineaspis scale.

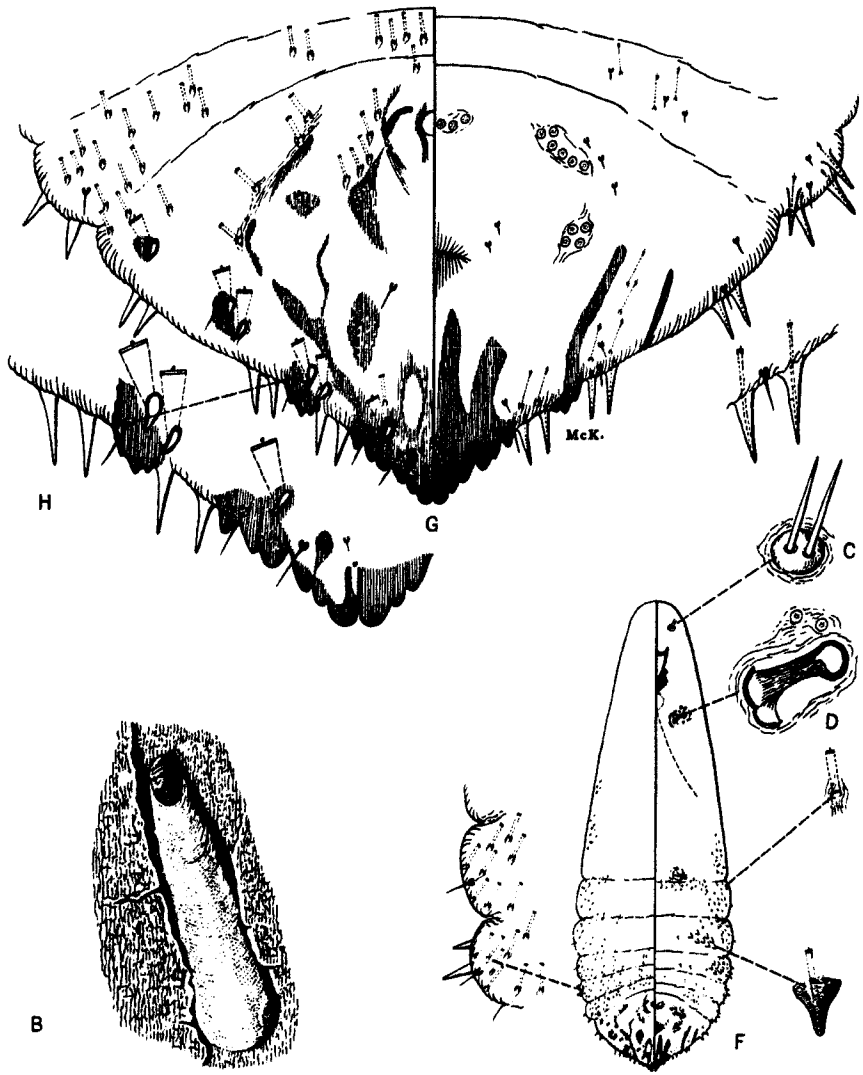

Fig. 99. *Neopinnaspis harperi* McKenzie, Harper scale.

elongate first exuvia which overlaps the second exuvia at terminal end, often partly concealed by a thin film of wax, color brown to gray-brown depending on waxy secretion; male scale unknown.

Additional hosts: Taken only on *Podocarpus.*

Discussion:

The pygidial lobes of this species resemble the pygidial plates except for a slightly more pronounced sclerotization. Also the gland tubercles on prosoma are confined to an elongate crowded group near each anterior spiracle. These characters serve to positively identify this species.

California records:

San Francisco Co.: San Francisco, V-4-38 (J. B. Steinweden, S. Smith and M. L. Jones).

Lineaspis cupressi (Coleman)
California lineaspis scale
(Fig. 98)

Leucaspis cupressi Coleman, 1903, Jour. N.Y. Ent. Soc., 11:71, illus.

Cupidaspis cupressi (Coleman), MacGillivray, 1921, The Coccidae, p. 363.

Lineaspis cupressi (Coleman, Ferris, 1937, Atlas of Scale Insects, Ser. I:78.

Type locality: Lake County, California.

Type host: *Cupressus goveniana.*

Relation to host: Occurring on the foliage. Adult female scale slightly elongate, white, the exuviae terminal end covered with a secretion; male scale white, elongate, exuvium apical.

Additional hosts: *Cupressus forbesii, Cupressus macnabiana, Cupressus macrocarpa, Juniperus monosperma, Juniperus pachyphloea, Juniperus utahensis, Juniperus* spp., and *Libocedrus utahensis.*

Discussion:

This species is apparently restricted in its host preferences to members of the Cupressaceae. The median pygidial lobes are smaller than the second pair, and this character aids in the identification of the species.

California records:

Kern Co.: Tehachapi, II-14-46 (C. S. Morley and J. B. Steinweden).

Lake Co.: Cobb, VI-3-35 (D. Custer).

Los Angeles Co.: Newhall, VIII-13-30 (G. R. Gorton).

Orange Co.: Coal Canyon, I-1935 (C. R. Tower).

San Diego Co.: Otay Mountain, XII-9-35 (A. Forbes, D. Taylor, and H. H. Keifer).

Santa Barbara Co.: Cuyama Valley, III-17-55 (G. Beevor).

Neopinnaspis harperi McKenzie
Harper scale
(Fig. 99)

Neopinnaspis harperi McKenzie, 1949, Calif. Dept. Agric. Bull., 38(3):123-126.

Type locality: Montecito, Santa Barbara County, California.

Type host: *Ceratonia siliqua,* carob.

Relation to host: Occurring principally on the bark of twigs and branches and, in cases of heavy infestations, on the trunk of the host species. Observed also at leaf bases in and about the leaf petioles, but apparently seldom infesting the expanded leaf surface. Adult female scale elongate and narrow, generally more or less irregular in shape, whitish with a light brown tinge in part, the first and second exuviae when exposed of a bright bronze; male scale not observed and apparently nonexistent.

Additional hosts: This species is extremely omnivorous, having been recorded from fifty host species at the time it was described. In addition to *Ceratonia siliqua* (carob) the preferred hosts appear to be *Aberia caffra, Ceasalpinia echinata, Ceanothus arboreus, Hakea saligna, Lagunaria Patersonii, Photinia serrulata, Prunus caroliniana, Prunus ilicifolia, Prunus lusitanica,* and *Prunus Lyoni.* Some secondary or casual hosts include: *Acacia decurrens* variety *dealbata, Acacia longifolia, Acacia melanoxylon, Acer palmatum, Arbutus unedo, Azara microphylla, Camellia japonica, Ceanothus spinosus, Cotoneaster microphylla, Crataegus* sp., *Cytisus scoparius, Diospyros kaki, Escallonia rubra, Euonymus japonicus, Ficus carica, Fraxinus* sp., *Grewia caffra, Jasminum revolutum, Juglans nigra, Juglans regia, Ligustrum ovalifolium, Macadamia ternifolia* variety *intergrifolia, Magnolia* sp., *Nerium oleander, Olea europaea, Persea americana, Pittosporum undulatum, Populus* sp., *Prunus amygdalus, Prunus persica, Punica granatum, Pyrus communis, Rosa* sp., *Salix discolor, Salix* sp., *Schinus molle, Schinus terrebinthinthifolia, Sparmannia,* and *Umbellularia californica.*

Discussion:

Neopinnaspis harperi apparently has some affinities for certain *Pinnaspis* and *Lepidosaphes* species, and for this reason it is suspected to be an introduced rather than a native species.

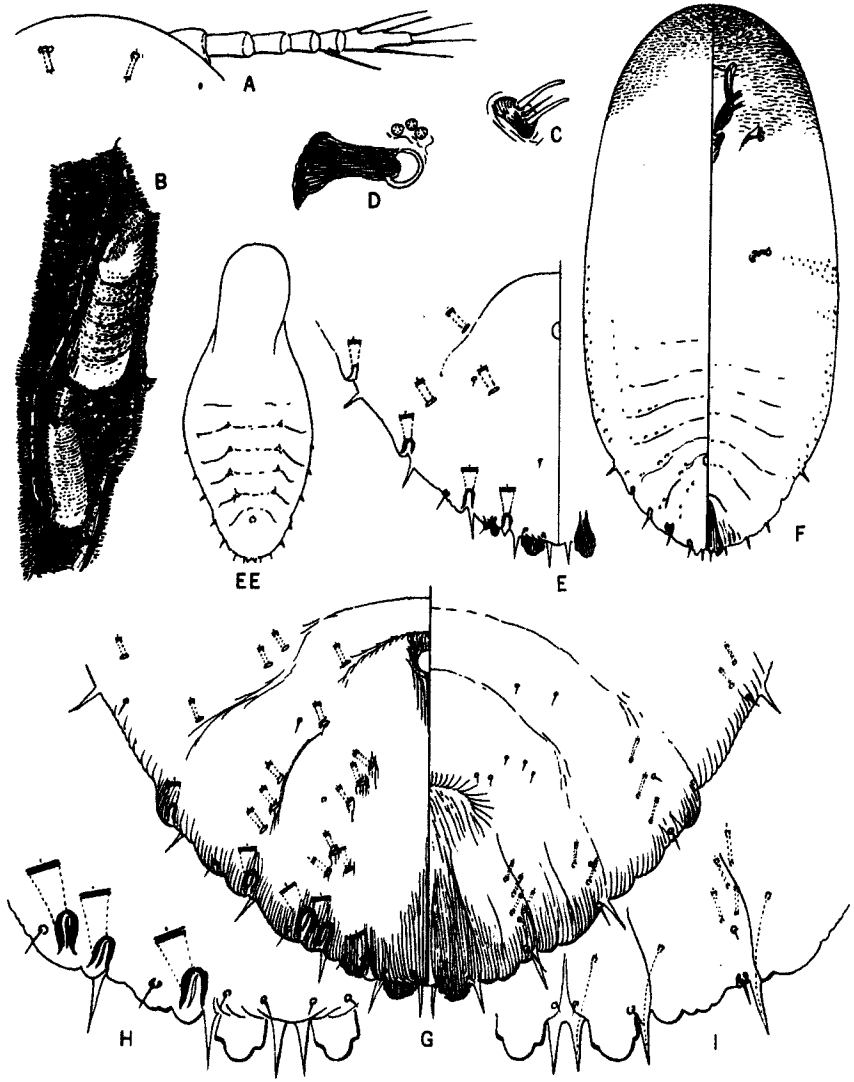

Fig. 100. *Nilotaspis halli* (Green), Hall scale.

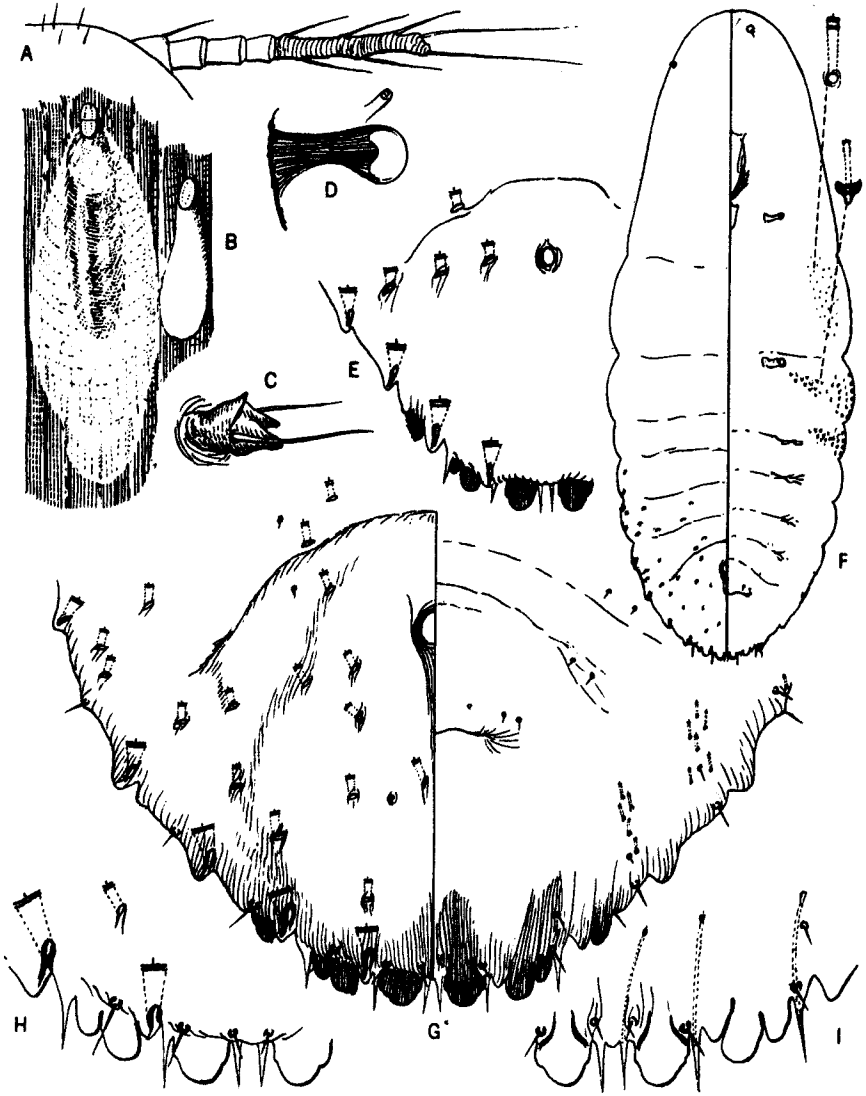

Fig. 101. *Pallulaspis ephedrae* Ferris, ephedra scale.

The genus *Neopinnaspis* McKenzie was recently (1955) synonomyzed with *Africaspis* MacGillivary by Ferris (Microentomology, 20(2):23, illus.). However, I do not accept this change for the following reasons: *Neopinnaspis* possesses dorsal marginal pygidial macroducts with orifices several times larger than the median and other macroducts, whereas in *Africaspis* the orifices of all the macroducts are approximately the same size throughout. Also, in *Neopinnaspis* the marginal pygidial macroduct orifices are essentially vertical to pygidial margin, whereas in *Africaspis* these structures are predominately parallel to the margin. Other differences are exhibited in the median pygidial lobes, these apparently much more closely appressed in *Neopinnaspis* than in *Africaspis*.

The above remarks have been based upon an examination of paratype, cotype, and other examples of several species of *Africaspis* which were kindly made available to me, as a loan, by Dr. W. J. Hall and Dr. D. J. Williams, both of the British Museum (Natural History) in London. To them I express my sincere appreciation. Specimens of *Africaspis* actually examined include: *Africaspis baphiae* Hall (paratype), *A. chipingae* Hall (paratype), *A. communis* variety *diospyros* Hall (cotype), *A. communis* variety *berlinae* Hall (cotype), and *A. (Chionaspis) caffra* Brain.

California records:

Santa Barbara Co.: Montecito, IV-12-49 (R. W. Harper). Santa Barbara, V-17-49 (R. W. Harper and R. J. Reid).

Nilotaspis halli (Green)
Hall scale
(Pl. 3, top row, center; fig. 100)

Lepidosaphes (Coccomytilus) halli Green, 1923. Minist. Agric., Egypt, 36:63, illus.

Nilotaspis halli (Green), Ferris, 1941, Atlas of Scale Insects, Ser. III:301.

Nilotaspis halli (Green), Keifer, 1941. Calif. Dept. Agric. mimeo., Fol. 13.

Type locality: Cairo, Egypt

Type host: *Prunus* sp.

Relation to host: Occurring in cracks of the bark. Adult female scale very small, elongate, rather short and broad, generally more or less irregular, whitish with a light brown tinge, second exuvia, when exposed, a bright yellow brown; male scale more slender than adult female although essentially the same color.

Additional hosts: The scale occurs mainly on rosaceous host types of the genus *Prunus*. Of these, almond, peach, plum, nectarine, and prune seem preferred. Collections of this scale have been made on *Cydonia vulgaris, Prunus amygdalus, Prunus armeniaca, Prunus bokhariensis, Prunus domestica, Prunus persica, Prunus* spp., and *Spiraea veitchi* (seedling).

Discussion:

This species is known as "Hall Scale" to economic entomologists. It is the subject of intense eradication by the Federal Department of Agriculture. The minute size of this scale species, together with a paucity of morphological details on the prepared slide example, precludes confusion with other diaspidids in California.

California records:

Butte Co.: Chico, II-3-34 (C. F. Kinman). Oroville, VII-2-46 (H. Richardson and L. F. Hosbrook).

Yolo Co.: Davis, X-13-47 (F. M. Summers).

Pallulaspis ephedrae Ferris
Ephedra scale
(Fig. 101)

Pallulaspis ephedrae Ferris, 1937, Atlas of Scale Insects, Ser. I:83.

Type locality: Darwin Mesa, Inyo County, California.

Type host: *Ephedra nevadensis*.

Relation to host: Occurring on the stems. According to Ferris (1937) the adult female scale is elongate, thin, white, almost transparent, the second exuvium, which occupies about half its length, showing as a brown patch, the exuviae terminal; male scale white, elongate, exuvium at one end.

Additional hosts: Recorded only from *Ephedra nevadensis*.

Discussion:

This species is distinguishable from other similar North American species by the absence of perivulvar pores, combined with the well-separated, broad median pygidial lobes, well-developed second lobes, unpaired marginal ducts of the pygidium, few and scattered dorsal pygidial ducts, and absence of gland spines on the prepygidial abdominal segments.

California records:

Inyo Co.: Darwin Mesa, VI-1930 (G. F. Ferris).

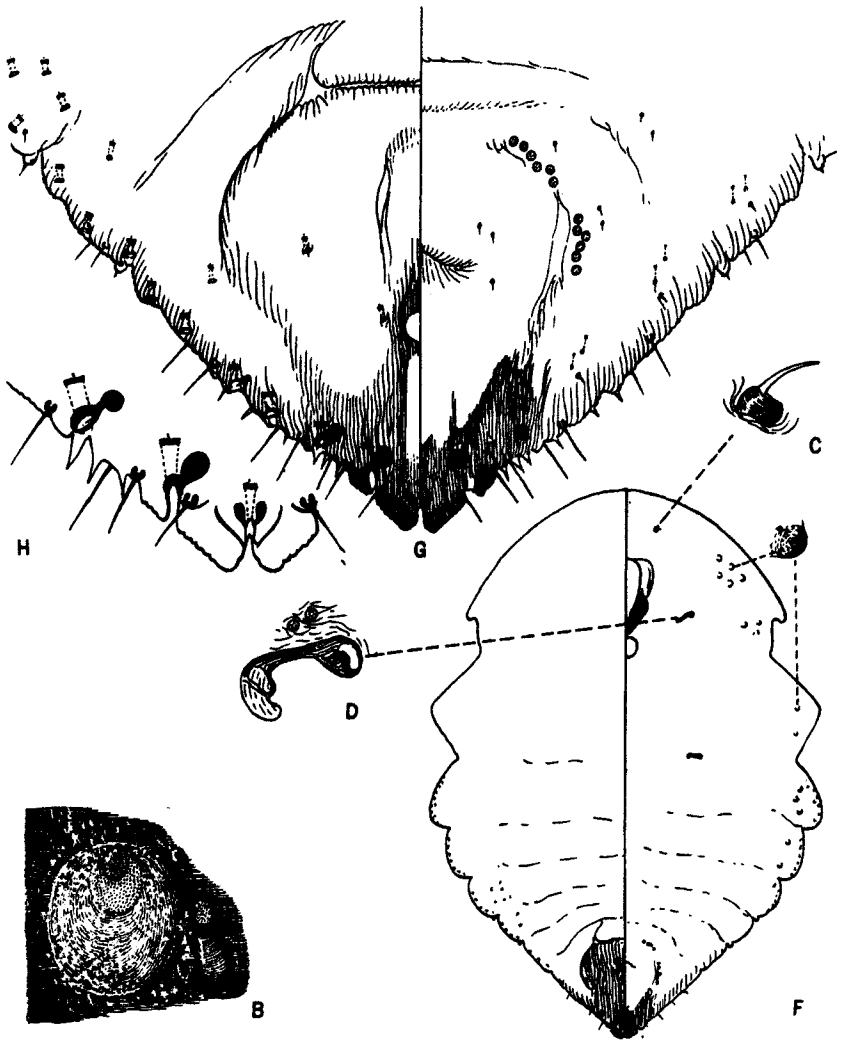

Fig. 102. *Parlatoreopsis chinensis* (Marlett), Chinese obscure scale.

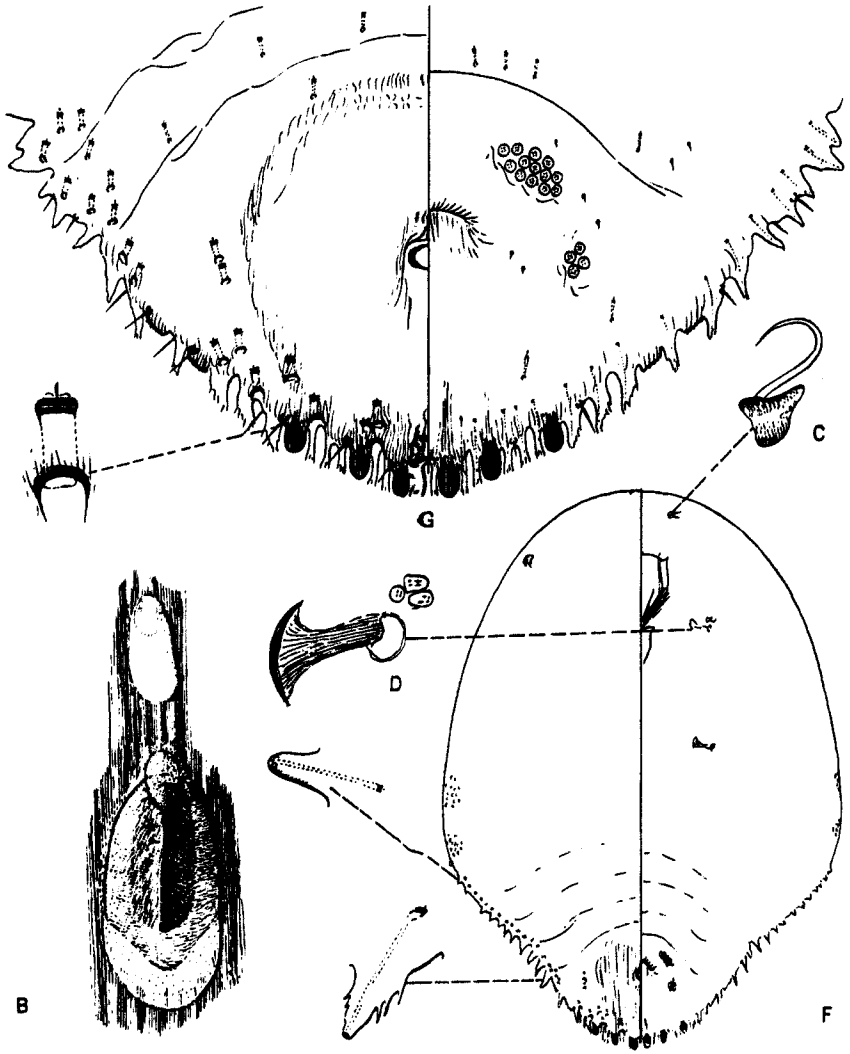

Fig. 103. *Parlatoria Blanchardii* (Targioni-Tozzetti), parlatoria date scale.

Parlatoreopsis chinensis (Marlatt)
Chinese obscure scale
(Fig. 102)

Parlatoria chinensis Marlatt, 1908, U.S.D.A. Bur. Ent., Tech. Ser. 16:30, illus.

Parlatoreopsis chinensis (Marlatt), Ferris, 1942, Atlas of Scale Insects, Ser. IV:405.

Parlatoreopsis chinensis (Marlatt), McKenzie, 1945, Microentomology, 10(2):84, illus.

Type locality: Tientsin, China.

Type host: Crab apple.

Relation to host: Occurring on bark of twigs. Adult female scale approximately circular or irregular, gray, thin, flattish, exuviae at one end; male scale elongate, similar in color to the female, exuvium apical.

Additional hosts: Recorded from a long list of hosts some of which are: *Aesculus, Albizzia, Aronia, Asimina, Bauhina, Betula, Broussonetia, Cassia, Cornus, Corylus, Cotoneaster, Crataegus, Elaeagnus, Euonymus, Ficus, Hibiscus, Juglans, Ligustrum, Maclura, Malus* sp. (crab-apple), *Nerium, Olea, Photinia, Pistachia, Pittosporum, Prunus, Pyracantha, Pyrus, Rhamnus, Rhus, Ribes, Robinia, Rosa, Salix, Spiraea, Syringa, Thuja, Tilia, Viburnum, Zanthoxylum,* and *Zizyphus.*

Discussion:

This species is the "Chinese obscure scale" of economic entomologists. According to the present author (1945) the genus is native to the Manchurian subregion of the Palearctic region. In California the scale has been found scattered throughout the Huntington Gardens and in several adjoining blocks outside these gardens. Apparently the infestation is one of long standing. Evidence obtained in the course of survey and research conducted by the Federal Bureau of Entomology in Missouri, and information available concerning the infestation in Florida, indicate the species is not a serious economic pest in the parts of the United States where it is now known to occur. This species is a member of the Parlatoriine Series. The group is characterized by having marginal pygidial macroducts between seventh and eighth segments, with associated clavate scleroses.

California records:

Los Angeles Co.: Pasadena, V-28-48 (V. Daniels and R. W. Harper). San Marino, V-14-48 (R. W. Harper).

Parlatoria Blanchardii (Targioni Tozzetti)
Parlatoria date scale
(Fig. 103)

Coccus Blanchardii Targioni Tozzetti, 1868, Societa Italiana de Scienze Naturali, p. 725.

Aonidia Blanchardii Targioni Tozzetti, 1892, Boll. Soc. ent. ital., 33:170.

Apteronidia blanchardi (Targioni), Berlese, 1895, Riv. Patol. veg., 4:80 (footnote).

Parlatoria victrix Cockerell, 1896, Entomologist, 29:52.

Parlatoria proteus variety *palmae* Maskell, 1898, Trans. N.Z. Inst., 30:229, illus.

Websteriella blanchardi (Targioni), MacGillivray, 1921, The Coccidae, p. 247.

Parlatoria blanchardii (Targioni), Ferris, 1937, Atlas of Scale Insects, Ser. I:85.

Parlatoria brauchardi [*sic*] (Targioni-Tozzetti), Borkhsenius, 1937. U.S.S.R. People's Comissariat for Agriculture, Plant Quarantine Administration, Plant Quarantine of Georgia, p. 186.

Parlatoria blanchardi (Targioni-Tozzetti), Morrison, 1939, U.S.D.A. misc. publ., 344:7, illus.

Parlatoria blanchardi (Targioni-Tozzetti), Boyden, 1941, U.S.D.A. misc. publ., 433:21, illus.

Parlatoria Blanchardii (Targioni-Tozzetti), McKenzie, 1945, Microentomology, 10(2):58, illus.

Type locality: Sahara Desert, Africa.

Type host: *Phoenix dactylifera,* date palm.

Relation to host: Occurring on leaves and fruit of the host. Adult female scale made up in large part of the second exuvia and an apical appendage of wax, the exuviae yellowish-brown with the thin and semitransparent first exuvia at the anterior end, scale appearing thin and light; male scale elongate, white with the exuvia pale.

Additional hosts: Recorded only from various palms. In addition to date palm, the Doum palm *(Hyphaene thebaica),* the Canary Island palm *(Phoenix canariensis),* and the native California fan palm *(Washingtonia filifera)* are also listed as hosts.

Discussion:

This species is the "parlatoria date scale" of economic entomologists. In California it has been the subject of a successful eradication program, sponsored by the Federal Bureau of Entomology and Plant Quarantine during 1928-1936.

The host specificity of this species, together

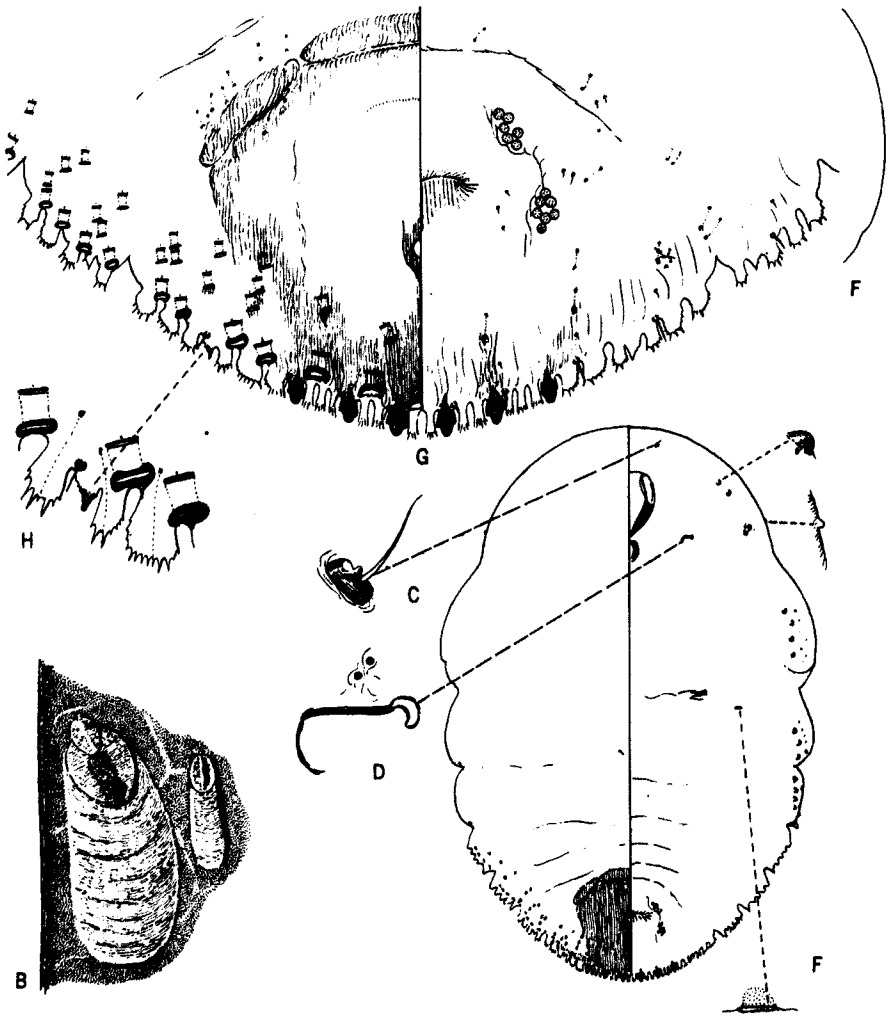

Fig. 104. *Parlatoria camelliae* Comstock, camellia parlatoria scale.

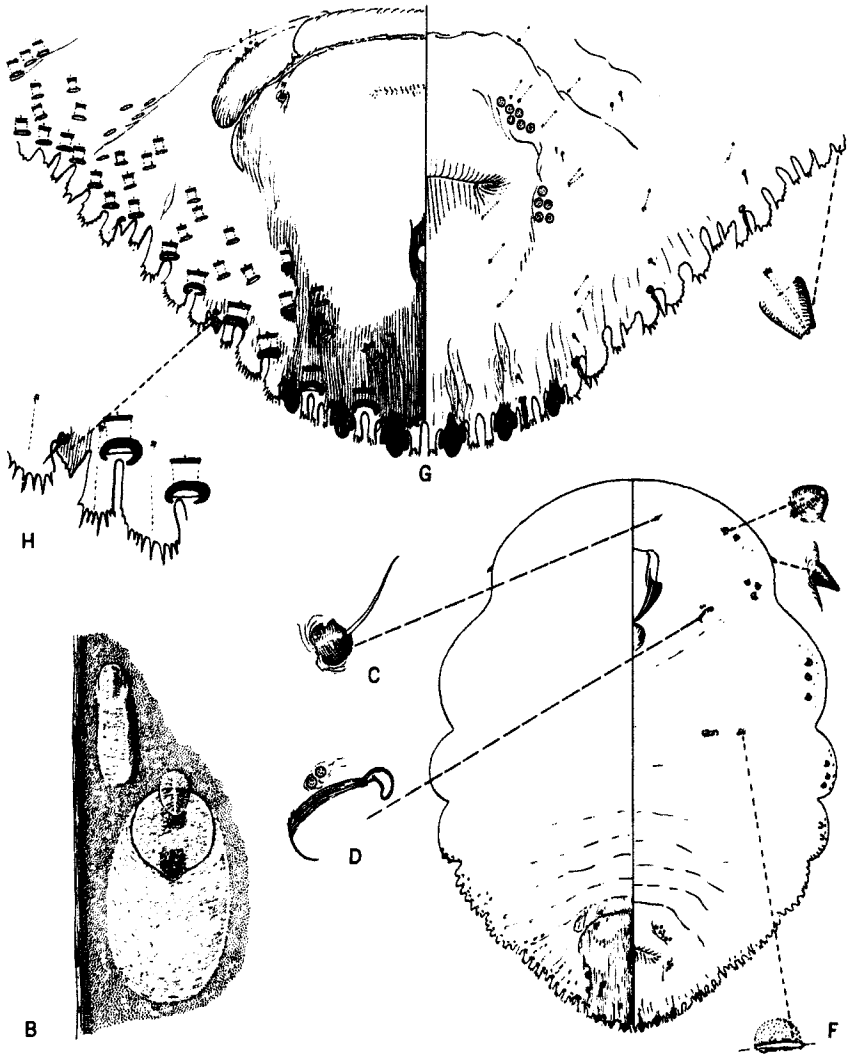

Fig. 105. *Parlatoria crotonis* Douglas, croton parlatoria scale.

with the total absence of ventral duct tubercles on the prosoma, serves to identify this scale from other California parlatorias.

California records:

Imperial Co.: El Centro, II-2-14 (F. W. Warte).

Riverside Co.: Indio, 1929, (B. L. Boyden). Coachella, 1924.

In addition to the above localities, Boyden (1941) lists Coachella Valley in Riverside County with the following areas infested with this scale: Arabia District, Coachella; Martinez District; Mecca; Palm Springs; Thermal and West Side District. In Imperial Valley of Imperial County he reports Heber and Holtville as additional infested areas.

Parlatoria camelliae Comstock
Camellia parlatoria scale
(Pl. 3, middle row, left; fig. 104)

Parlatoria pergandii variety *camelliae* Comstock, 1883, Rep. Dept. Ent. Cornell Univ., 2:144, illus.

Parlatoria pergandii Comstock, Kuwana, 1925. Imp. Plant Quaran. Serv. Japan, Rev. Bur., Tech. Bull. 1, pl. 2, illus.

Parlatoria camelliae Comstock, Morrison, 1939, U.S.D.A. misc. publ., 344:8, illus.

Parlatoria camelliae Comstock, Keifer, 1941. Calif. Dept. Agric. mimeo., Fol. number 2.

Parlatoria camelliae Comstock, Ferris, 1942, Atlas of Scale Insects, Ser. IV:400.

Parlatoria camelliae Comstock, McKenzie, 1945, Microentomology, 10(2):58-59, illus.

Type locality: Washington, District of Columbia.

Type host: *Camellia* sp.

Relation to host: Occurring principally on the leaves. Adult female scale elongate oval, moderately convex, white or gray, second exuvia pale except for a dark median area which is yellowish or at times with a faint greenish hue; male scale elongate, gray.

Additional hosts: *Acer, Aegle, Azalea, Berberis, Cinnamomum, Citrus, Codiaeum, Euonymus, Ilex, Jasminum, Mangifera, Melia azadirachta, Myrtus, Olea, Osmanthus, Poncirus, Quercus acuta, Quercus myrsinaefolia,* and *Vitis.*

Discussion:

This species is reported as the most important scale pest of *Camellia* in California. This scale seems easy enough to determine on camellias since it differs from other camellia scales in California by its color, shape, and general habitus.

California records:

This species is very common in California greenhouses and may be found out-of-doors infesting plants growing in protected places. A few of the California State Department of Agriculture records include:

Butte Co.: Chico, XII-24-37 (R. Swett). Oroville, V-14-41 (J. B. Steinweden).

El Dorado Co.: Placerville, III-24-32 (A. C. Browne).

Fresno Co.: Fresno, I-12-40 (J. W. Dixon).

Kings Co.: Hanford, II-26-41 (T. B. Gallion).

Los Angeles Co.: Monterey Park, X-16-36 (V. E. Williams).

Marin Co.: San Rafael, III-11-39 (T. Peryam).

Merced Co.: Merced, V-12-42 (Casebolt).

Monterey Co.: Monterey, VI-19-42 (R. N. Weir).

Napa Co.: Napa, II-3-41 (W. D. Butler).

Orange Co.: Orange, I-13-38 (J. B. Walden).

Placer Co.: Auburn, XII-18-39 (J. W. Dixon).

Riverside Co.: Riverside, X-19-42 (C. E. Ehmann).

Sacramento Co.: Roseville, II-3-32 (B. B. Whitney). Sacramento, II-27-33 (M. L. Jones).

San Bernardino Co.: Uplands, VII-3-42 (C. R. Tower).

San Diego Co.: San Diego, XII-5-44 (D. F. Palmer).

San Joaquin Co.: Lodi, I-13-40 (J. W. Dixon).

San Mateo Co.: Colma, II-18-44 (Cresta).

Santa Clara Co.: San Jose, VII-24-32 (M. R. Bell).

Sonoma Co.: Molino, XI-14-41 (M. R. Bell).

Stanislaus Co.: Oakdale, II-6-45 (W. McDaniel).

Sutter Co.: Live Oak, XII-14-39 (J. W. Dixon).

Yolo Co.: Woodland, IV-1-47 (Collister).

Yuba Co.: Marysville, IV-22-42 (A. W. Worledge).

Parlatoria crotonis Douglas
Croton parlatoria scale
(Fig. 105)

Parlatoria proteus variety *crotonis* Douglas, 1887, Ent. Mon. Mag., 23:242.

Parlatoria pergandei variety *crotonis* Cockerell, 1892, Insect Life, 4:334.

Parlatoria greeni Banks, 1906, Philipp. Jour. Sci., 1:222-231, illus.

Parlatoria crotonis Douglas, Morrison, 1939, U.S.D.A., misc. publ., 344:12, illus.

Parlatoria crotonis Douglas, Ferris, 1942, Atlas of Scale Insects, Ser. IV:401.

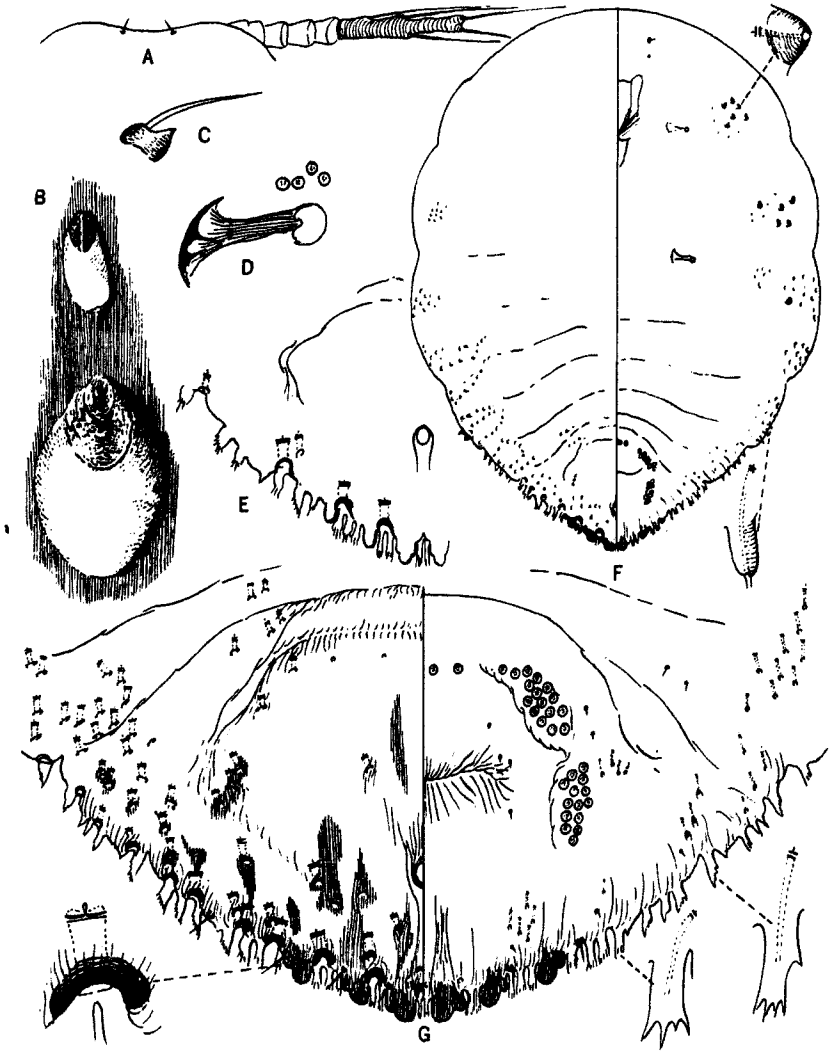

Fig. 106. *Parlatoria oleae* (Colvée), olive parlatoria scale.

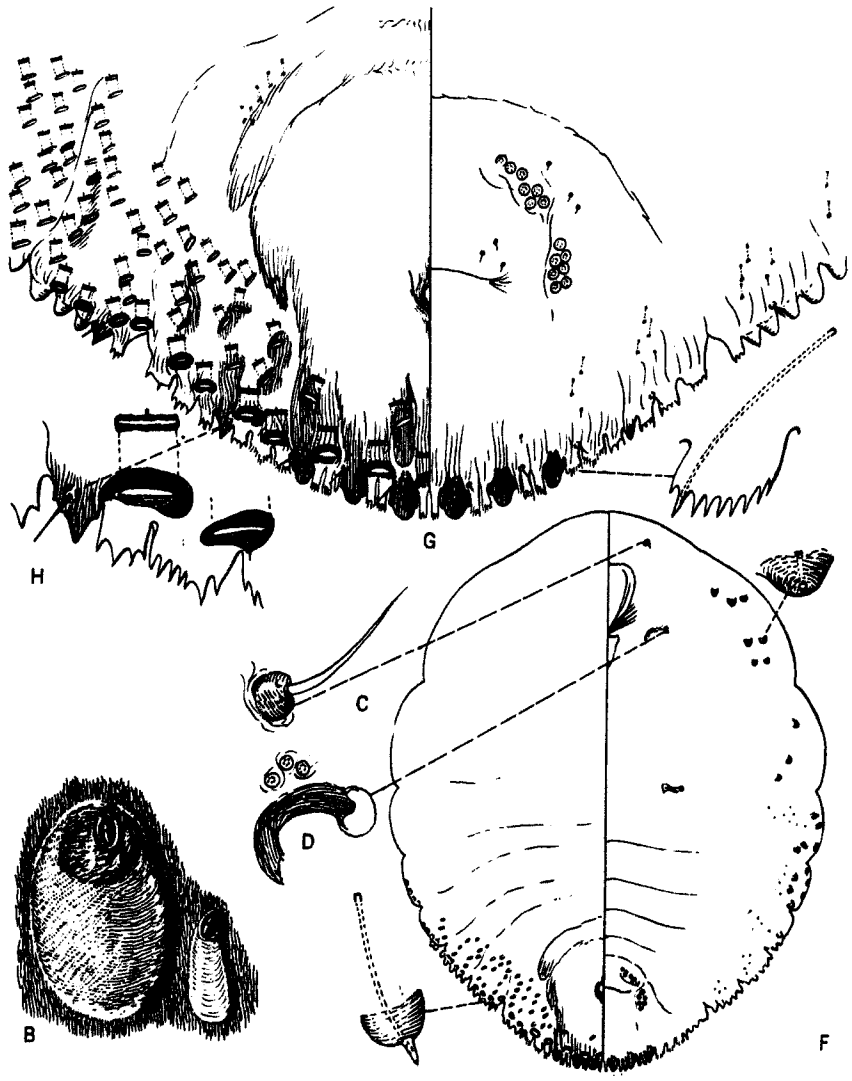

Fig. 107. *Parlatoria pergandii* Comstock, chaff scale.

Parlatoria crotonis Douglas, McKenzie, 1945, Microentomology, 10(2):61-62, illus.

Parlatoria crotonis Douglas, Zimmerman, 1948, Insects of Hawaii, 5:396, illus.

Type locality: London.

Type host: *Codiaeum* sp., croton..

Relation to host: Occurring principally on the leaves. Adult female scale elongate, flat, distinctly yellowish, exuviae at one end, the second exuvia yellowish or greenish with irregular darker median area; male scale elongate and yellowish.

Additional hosts: *Acer, Dendrobium, Ficus, Illicium,* and *Laurus nobilis.* Its occurrence on these hosts is to be regarded as doubtful until confirmed.

Discussion:

This species is apparently most closely related to *Parlatoria camelliae* Comstock but differs in the enlargement of the eyespot into a stout prosomal marginal spur.

California records:

Los Angeles Co.: Los Angeles, VI-24-35 (V. E. Williams).

Parlatoria oleae (Colveé)
Olive parlatoria scale
(Pl. 3, middle row, right; fig. 106)

Parlatoria oleae Colveé, 1880, Gac. agric. Minist. Fomento Spain, 14(2):39.

Parlatoria calianthina Berlese and Leonardi, 1895, Riv. Patol. veg., 3:346..

Parlatoria affinis Newstead, 1897, Trans. Ent. Soc. London, p. 97.

Parlatoria (Euparlatoria) calianthina Berlese and Leonardi, Leonardi, 1903, Estratto dagli Annali della R. Scuola Superiore di Agricoltura in Portico, 5:16, illus.

Parlatoria oleae (Colveé), Nichol and Wehrle, 1935, Arizona Agric. Expt. Sta., Tech. Bull. 56:201-235, illus.

Parlatoria oleae (Colveé), Ferris, 1937, Atlas of Scale Insects, Ser. I:87.

Syngenaspis oleae (Colveé), Borkhsenius, 1937. U.S.S.R. People's Commissariat for Agriculture, Plant Quarantine of Georgia, Division of Scientific Literature, p. 87, illus.

Parlatoria oleae (Colveé), Morrison, 1939, U.S.-D.A. misc. publ. 344, p. 15, illus.

Parlatoria oleae (Colveé), Keifer, 1941, Calif. Dept. Agric. mimeo. Fol. no. 1

Parlatoria oleae (Colveé), McKenzie, 1945, Microentomology, 10(2):69-70, illus.

Parlatoria oleae (Colveé), McKenzie, 1952, Calif. Dept. Agric. Bull., 41(3):127-138, illus.

Type locality: Spain.

Type host: *Olea europaea,* olive.

Relation to host: Occurring on the leaves or bark of host. Adult female scale oval, moderately convex, white or gray, with brownish exuviae, second exuvia not exceptionally large, more or less covered with wax; male scale elongate, white, flat, the exuvia apical and usually brown or blackish.

Additional hosts: In California this scale has been collected by county and state inspectors from about 211 host species. Many of these hosts will not, however, support the scale by themselves and must depend upon replenishment from more preferred hosts. The preferred hosts include *Cotoneaster* spp., *Ligustrum* spp., *Mahonia aquifolium, Photinia arbutifolia, Prunus amygdalus, Prunus armeniaca, Prunus domestica, Prunus persica, Rosa* spp., and *Syringa* spp. The scale has not been found on conifers or citrus in California.

Discussion:

This is the "Olive parlatoria scale" of economic entomologists. Specifically, it may be distinguished from other California parlatorias by possessing four pygidial plates instead of the usual three, between third and fourth pygidial lobes.

California records:

This scale has spread consistently since its original discovery at Fresno in 1934, until now it ranges from San Diego County in the southern part of the state to Sutter and Yuba counties in the north. The heaviest concentration occurs in the central valleys of California, ranging from Kern to San Joaquin County. Only a few specific localities are here given:

Butte Co.: Biggs, III-24-54 (P. Hart and Martin Glynn). Gridley, IV-13-54 (M. Glynn and P. Hart). Oroville, III-3-53 (H. Shaffer).

Colusa Co.: Maxwell, XI-10-55 (F. F. Sandridge and K. G. Whitesell).

Contra Costa Co.: Antioch, V-6-54 (R. P. Allen).

Fresno Co.: Fresno, X-23-34 (C. Canfield).

Glenn Co.: Willows, XI-10-52 (S. T. Ancell).

Kern Co.: Buttonwillow, V-1-45 (C. E. Ehmann).

Los Angeles Co.: El Monte, IV-19-48 (V. E. Daniels and Dyer). Glendale, III-27-47 (V. E. Daniels). Los Angeles, VI-14-48 (V. E. Daniels). Sylmar, III-3-48 (V. E. Daniels).

Orange Co.: Fullerton, XII-6-50 (D. H. Byers).

Placer Co.: Lincoln, XII-16-52 (H. J. Crawford). Roseville, IV-28-47 (Collister).

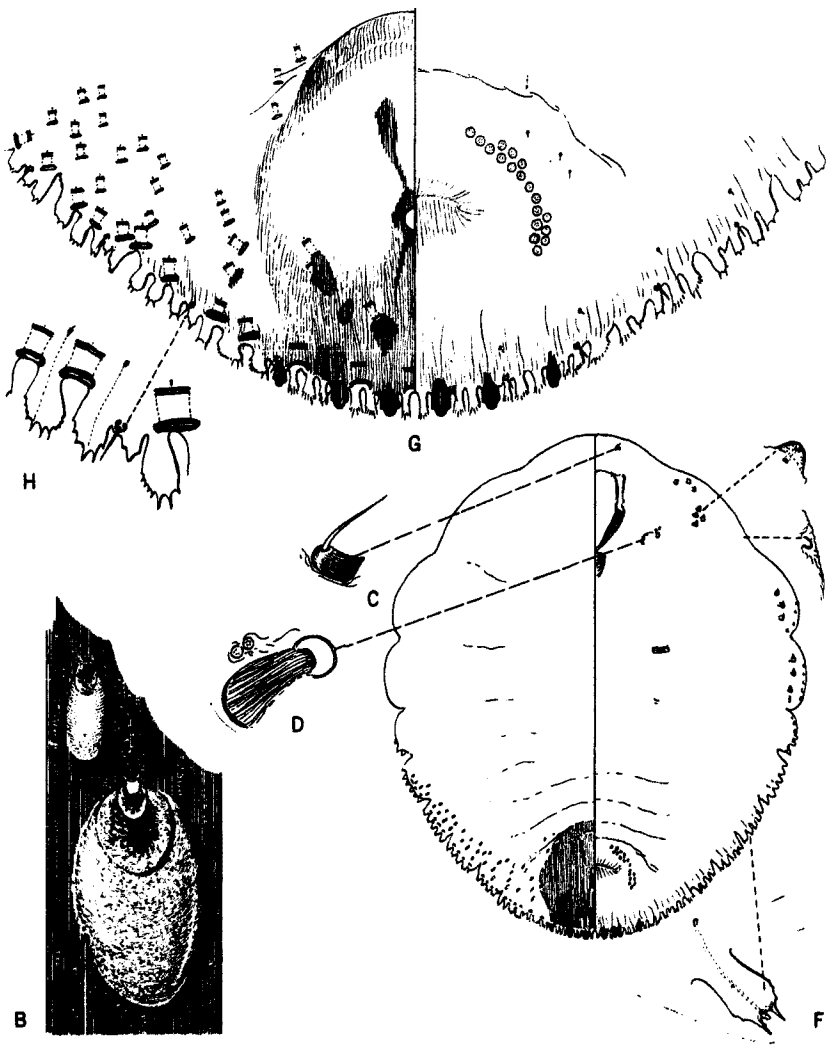

Fig. 108. *Parlatoria pittospori* Maskell, Pittosporum diaspidid.

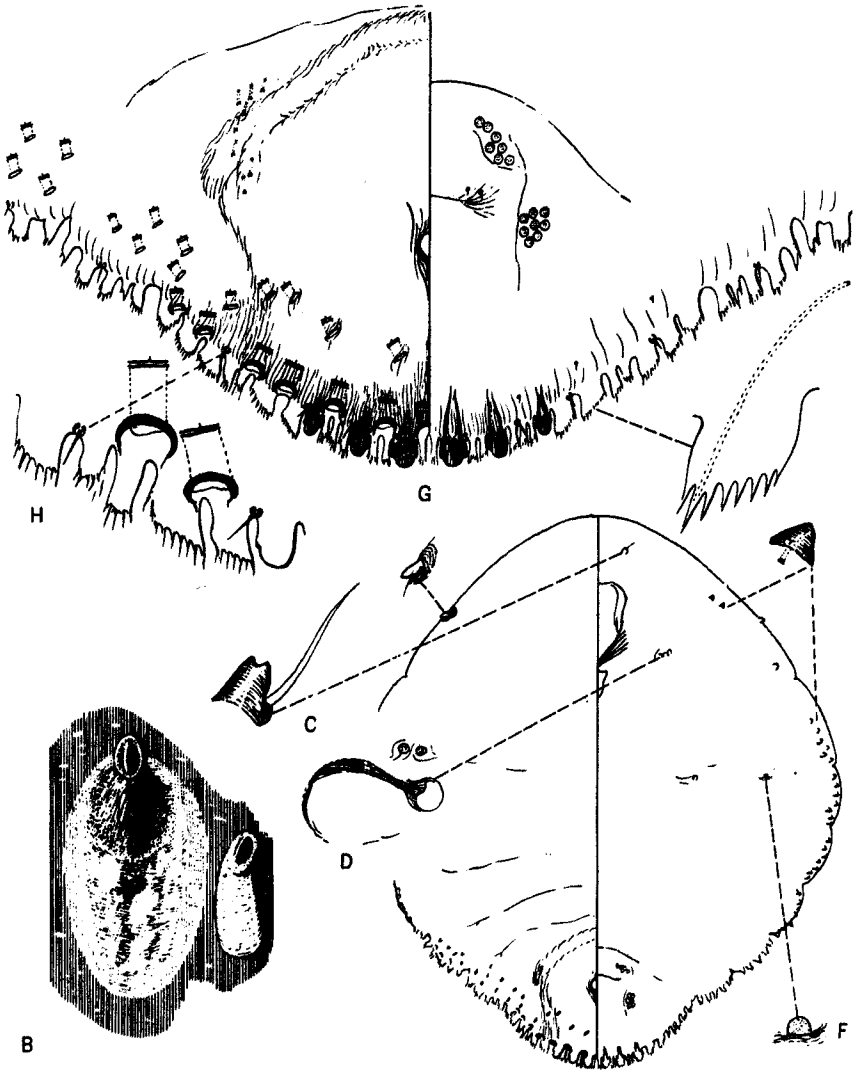

Fig. 109. *Parlatoria proteus* (Curtis), Proteus or sanseveria scale.

Riverside Co.: Riverside, IV-20-53 (N. Getz and Dill).

Sacramento Co.: Sacramento, II-24-47 (F. Daly).

San Bernardino Co.: Cucamonga, IV-26-51 (R. Camblin).

San Diego Co.: Poway Valley, IV-29-52 (F. Thorne).

San Joaquin Co.: Stockton, IV-18-46 (W. G. Vettel). Tracy, I-4-49 (F. Hutchings).

Stanislaus Co.: Denair, IV-1947 (E. E. Butman). Hughson, II-27-47 (E. E. Butman). Modesto, I-24-47 (E. T. Gammon).

Sutter Co.: Yuba City, V-29-47 (E. T. Gammon).

Tulare Co.: Visalia, I-11-45 (J. W. Dixon).

Tuolumne Co.: Sonora, X-10-52 (H. H. Sherrard).

Yuba Co.: Marysville, III-12-52 (R. W. Nelson).

Parlatoria pergandii Comstock
Chaff scale
(Fig. 107)

Parlatoria pergandii Comstock, 1881, Rep. U.S.-D.A. for 1880, p. 327, illus.

Parlatoria sinensis Maskell, 1897, Ent. Mon. Mag., 32:241.

Parlatoria pergandii Comstock, Ferris, 1937, Atlas of Scale Insects, Ser. I:88.

Syngenaspis pergandii (Comstock), Borkhsenius, 1937. U.S.S.R. Peoples' Comissariat for Agriculture, Plant Quarantine Administration, Plant Inspection of Georgia, Division of Scientific Literature, p. 88.

Parlatoria pergandii Comstock, Morrison, 1939, U.S.D.A., misc. publ. 344, p. 18, illus.

Parlatoria pergandii Comstock, McKenzie, 1945, Microentomology, 10(2):70-71.

Parlatoria pergandei Comstock, Zimmerman, 1948. Insects of Hawaii, 5:396, illus.

Type locality: Florida.

Type host: *Citrus.*

Relation to host: Occurring on the bark, leaves, and fruit of host. Adult female scale oval, whitish, gray or light brown, the exuviae darker, not unusually enlarged; male scale elongate oval and the same color as that of adult female.

Additional hosts: *Aucuba, Buxus, Elaeagnus, Euonymus, Garcinia morella, Jasminum amplexicaule, Myrtus, Severinia buxifolia, Tutcheria spectabilis, Vitis,* and *Yucca.*

Discussion:

This is the "chaff scale" of economic entomologists. The species is very closely related to *Parlatoria theae* Cockerell but differs in the absence of a derm pocket between posterior spiracle and body margin and fewer perivulvar pores.

Whenever this scale is found in California it is eradicated. Infestations of chaff scale have persisted for several years in certain southern California localities, although the species does not seem to spread aggressively throughout the state.

California records:

Los Angeles Co.: Monrovia, VI-25-53 (L. E. Myers). Pomona, VII-23-35 (V. E. Williams).

Sacramento Co.: Roseville, II-18-41 (J. B. Steinweden).

San Diego Co.: Pacific Beach, II-25-48 (K. H. Baker and R. W. Harper). San Diego, IV-5-49 (R. W. Harper and F. T. Thorne).

Ventura Co.: Santa Paula, III-14-42 (R. A. Young). Ventura, IV-19-34 (D. Fraser).

Parlatoria pittospori Maskell
Pittosporum diaspidid
(Pl. 3, bottom row, left; fig. 108)

Parlatoria pittospori Maskell, 1890, Trans. N.Z. Inst., 23:11.

Parlatoria myrtus Maskell, 1890, Trans. N.Z. Inst., 23:12.

Parlatoria dryandrae Fuller, 1897, Jour. Bur. Agric. Western Australia, 4:1344.

Parlatoria petrophilae Fuller, 1899, Trans. Ent. Soc. London, p. 468.

Parlatoria pittospori Maskell, Morrison, 1939, U.S.D.A., misc. publ. 344, p. 20, illus.

Parlatoria pittospori Maskell, Keifer, 1941. Calif. Dept. Agric., mimeo. Fol. no. 4.

Parlatoria pittospori Maskell, Ferris, 1942, Atlas of Scale Insects. Ser. IV:402.

Parlatoria pittospori Maskell, McKenzie, 1945, Microentomology, 10(2):71-72, illus.

Type locality: Australia.

Type host: *Pittosporum undulatum.*

Relation to host: Occurring on the leaves and stems. Adult female scale elongate oval, slightly convex, grayish or light brown, exuviae terminal and moderately large, second exuvia yellowish with a darker median area; male scale elongate and slightly lighter in color than female.

Additional hosts: *Agonis flexuosa, Banksia* sp., *Buxus balearica, Callistemon* sp., *Cedrus deodara, Cotoneaster microphylla, Cycas, Diosma, Dracaena draco, Dryandra* sp., *Erica* sp., *Hakea* sp., *Haworthia neilu, Leptospermum laevigatum, Leucadendron* sp., *Macrozamia corallipes, Malus* sp., *Melaleuca nesophila, Mimosa* sp., *Nuytsia floribunda, Olea europeae,*

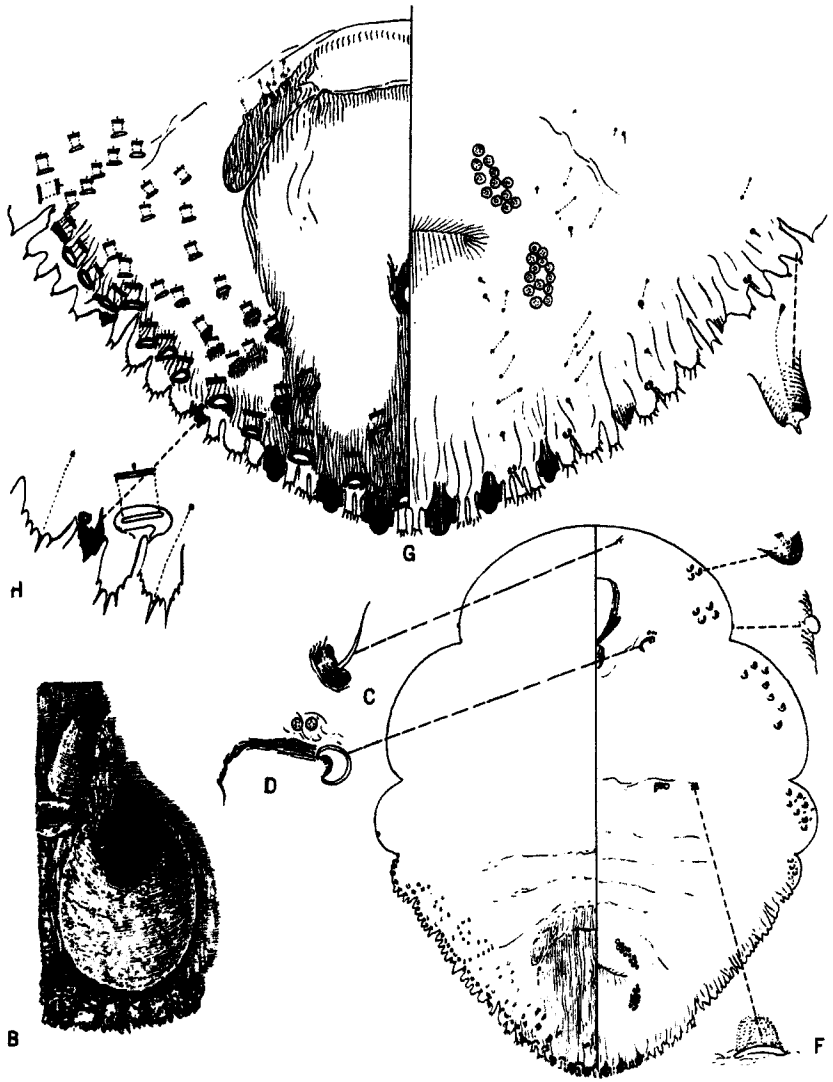

Fig. 110. *Parlatoria theae* Cockerell, tea parlatoria scale.

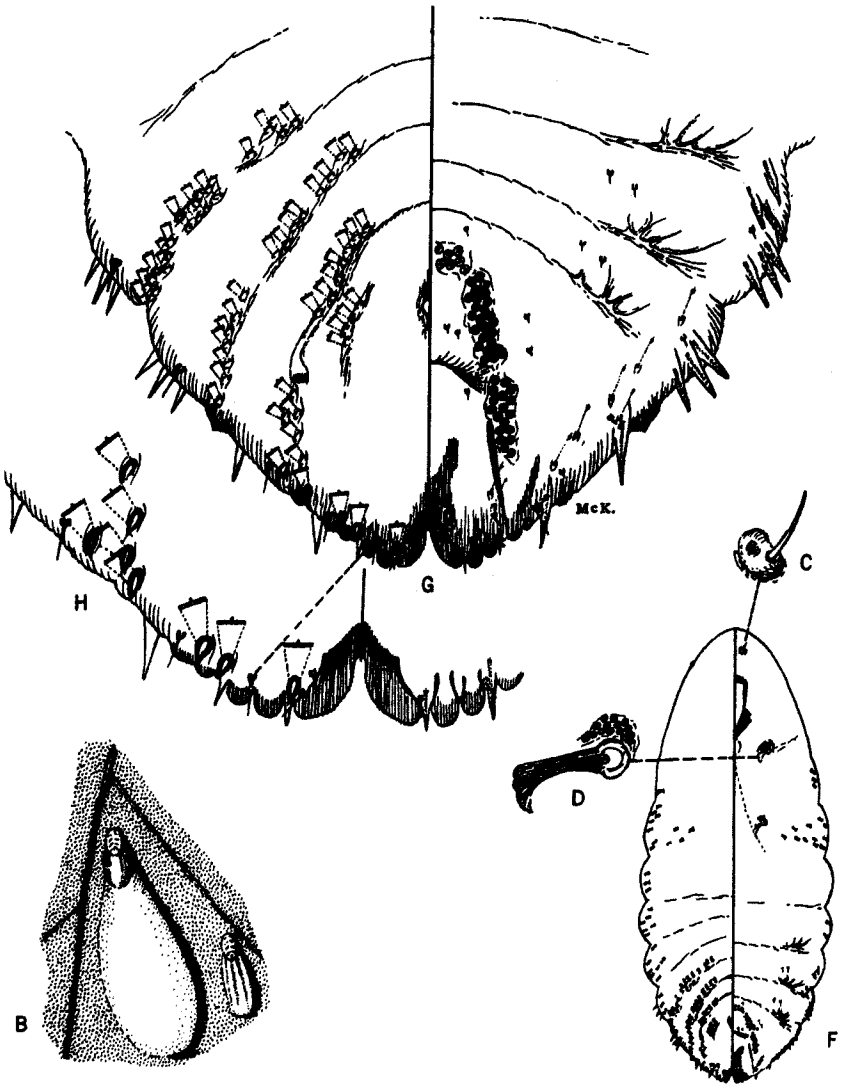

Fig. 111. *Phenacaspis fujicola* Kuwana, Fujicola scale.

Petrophila linearis, Phoenix canariensis, Pimelea linifolia, Pinus halepensis, Pinus radiata (=insignis), Pittosporum tobira, Podocarpus elongatus, Rosa sp., *Viburnum tinus,* and *Xanthorrhoea.*

Discussion:

This species appears to belong to the *pergandii, proteus,* and *crotonis* complex, but may be separated from all of these by the presence of dorsal macroducts on the intermediate part of the pygidium and on the segment anterior to this.

The scale has reportedly damaged deodar cedar *(Cedrus deodara)* in San Diego County. In nurseries it is eradicated when found.

California records:

Alameda Co.: Hayward, VII-17-53 (S. W. Sibray).

Los Angeles Co.: Los Angeles, IV-26-38 (F. R. Platt). Montebello, IV-25-35 (V. E. Williams). Pasadena, V-11-48 (R. W. Harper). San Marino, V-27-48 (V. E. Daniels and R. W. Harper).

San Diego Co.: Chula Vista, VII-23-48 (D. F. Palmer). National City, VII-27-48 (D. F. Palmer). San Diego, XII-28-43 (J. B. Steinweden and C. R. Tower).

Parlatoria proteus (Curtis)
Proteus or Sanseveria scale
(Fig. 109)

Aspidiotus proteus Curtis, 1843. Gdnrs.' Chron., p. 676.

Diaspis Parlatoris Targioni-Tozzetti, 1867. Mém. Soc. ital. Sci. nat., 3(3):14.

Parlatoria orbicularis Targioni-Tozzetti, 1868. Coccidarum Catalogus, Soc. ital. Sci. nat., 11:735.

Aspidiotus targionii del Guercio, 1894. Il Naturalista Siciliano, number 8.

Parlatoria (Euparlatoria) proteus (Curtis), Leonnardi, 1903. Estratto dagli Annali della R.Scuola superiore di Agricoltura in Portici, 5:23, illus.

Parlatoria proteus (Curtis), Kuwana, 1925. Imp. Plant Quaran. Serv., Japan Rev. Bur., Tech. Bull., 1:10, illus.

Parlatoria proteus (Curtis), Ferris, 1937, Atlas of Scale Insects, Ser. I:89.

Syngenaspis proteus (Curtis), Borkhsenius, 1937. U.S.S.R. People's Comissariat for Agriculture, Plant Quarantine Administration, Plant Quarantine Inspection of Georgia, Division of Scientific Literature, p. 89.

Parlatoria proteus (Curtis), Morrison, 1939. U.S.-D.A. misc. publ. 344:22, illus.

Parlatoria proteus (Curtis), McKenzie, 1945, Microentomology, 10(2):72-73, illus.

Parlatoria proteus (Curtis), Zimmerman, 1948. Insects of Hawaii, 5:396-404, illus.

Type locality: England.

Type host: Described as occurring on succulent leaves of a plant in greenhouses. Morrison (1939) suggests that this host might have been "an *Aloe* or *Amaryllis.*"

Relation to host: Occurring on bark, leaves, or fruit of host. Adult female scale elongate oval, slightly convex, very thin and delicate, semitransparent, second exuvia quite large, general color yellowish-brown; male scale elongate, white, exuvia yellowish-brown.

Additional hosts: The preferred hosts of *Parlatoria proteus* (Curtis) belong to two plant families, Orchidaceae and Palmaceae. The scale has been reported from the Orchidaceae on *Aerides, Arachnanthe rosea, Brassia, Cattleya, Coelogyne flaccida, Cymbidium, Cypripedium, Dendrobium, Epidendrum, Grammatophyllum speciosum, Maxillaria tenuifolia, Phalaenopsis, Renanthera, Rhynchostylis retusa, Saccolabium, Schomburgkia lyonsi, Stereochilus fasciata, Trichocentrum albo-purpureum,* and *Vanda.* From the Palmaceae on *Areca, Coccothrinax, Cocos, Kentia, Phoenix dactylifera, Sabal,* and *Thrinax.* Other hosts include *Agave, Aglaonema, Aspidistra, Billbergia, Citrus, Cycas. Dieffenbachia sequine, Gossypium (Thunbergia), Hedera, Macrozamia, Mangifera indica, Maranta massangeana, Monstera deliciosa, Philadelphus, Philodendron, Quercus, Sansevieria,* and *Yucca.*

Discussion:

This scale is a rather common one infesting certain nursery plants, and whenever found eradication measures are employed to destroy it. The species appears to be rather closely allied to *pergandii* but may be separated from it by the presence of a spurlike eyespot on the prosoma and the considerably fewer numbers of submarginal pygidial macroducts.

California records:

Alameda Co.: Berkeley, IV-28-47 (G. B. Laing).

Kern Co.: Bakersfield, XI-9-53 (E. Finnell).

Los Angeles Co.: Gardena, III-4-42. Lennox, VII-9-41. Los Angeles, I-13-37 (V. E. Williams). Montebello, IV-6-44 (J. B. Steinweden and L. E. Myers). San Gabriel, XI-13-36 (V. E. Williams).

Orange Co.: Santa Ana, III-21-41 (C. R. Tower).

Sacramento Co.: Sacramento, XII-4-47 (S. M. Mather and J. B. Steinweden).

San Diego Co.: San Diego, XII-9-52 (J. O. Wible and R. F. Wilkey).

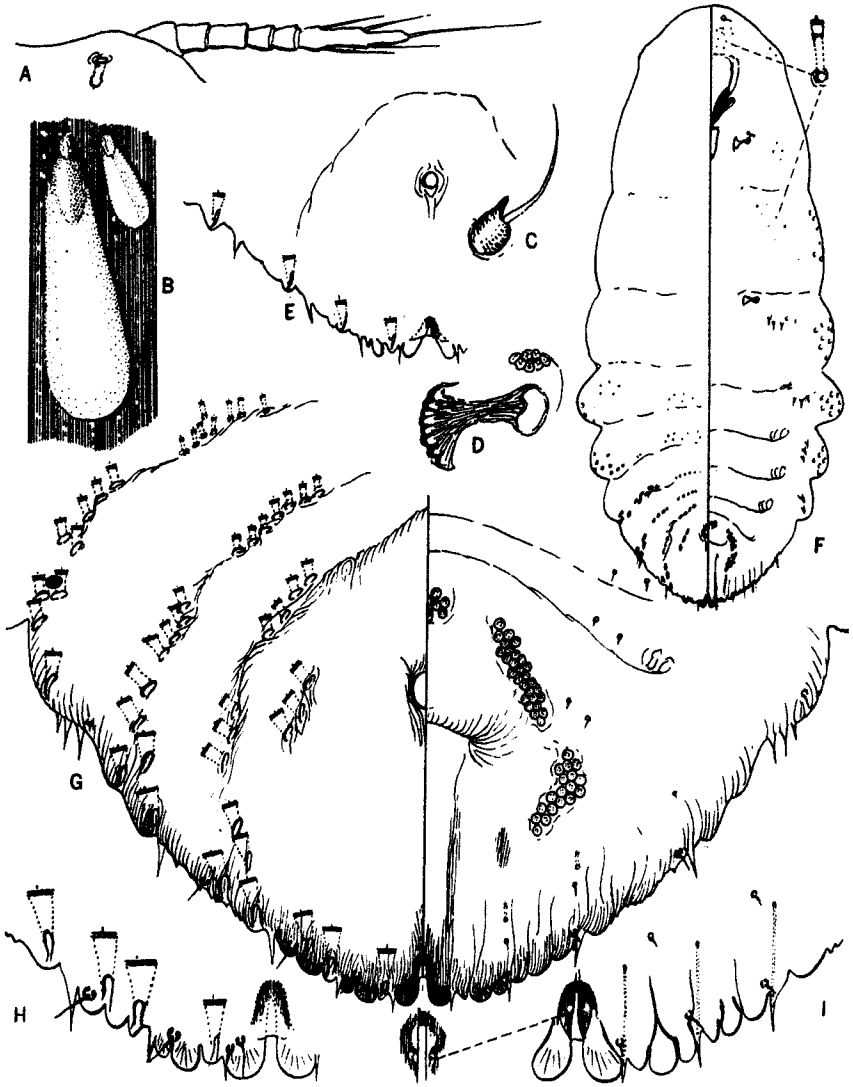

Fig. 112. *Phenacaspis pinifoliae* (Fitch), pine needle scale.

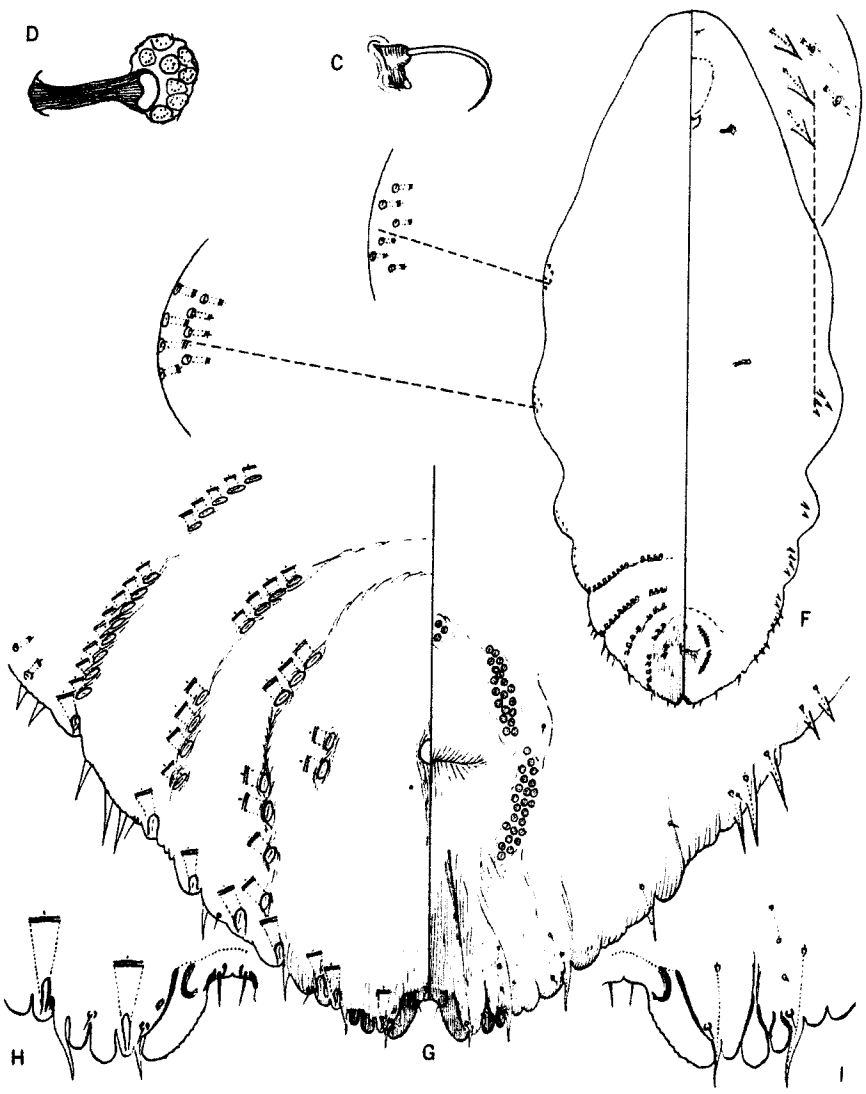

Fig. 113. *Phenacaspis sandwicensis* Fullaway, oleander scale.

San Francisco Co.: San Francisco, IV-26-44 (J. B. Steinweden).

San Mateo Co.: Colma, IV-22-42 (M. R. Bell). San Mateo, III-18-53 (C. M. Sill).

Santa Barbara Co.: Santa Barbara, VI-30-47 (I. B. Treloar).

Santa Cruz Co.: Santa Cruz, XI-21-52 (C. Lipska).

Solano Co.: Vallejo, VII-2-43 (M. R. Bell).

Stanislaus Co.: Turlock, V-8-51 (J. Kalstrom).

Parlatoria theae Cockerell
Tea parlatoria scale
(Fig. 110)

Parlatoria theae Cockerell, 1896, Psyche, Vol. 7, Suppl., p. 21.

Parlatoria theae variety *viridis* Cockerell, 1896, U.S.D.A. Div. Ent., Tech. Ser. 4:43.

Parlatoria theae variety *euonymi* Cockerell, 1897, Amer. Nat., 31:591.

Parlatoria (Euparlatoria) theae Cockerell, Leonardi, 1903. Estratto dagli Annali della R. Scuola superiore di Agricoltura in Portici, 5:19.

Parlatoria theae Cockerell, Kuwana, 1925. The Diaspine Coccidae of Japan, part 1. Imp. Plant Quaran. Serv., Japan Rev. Bur., Tech. Bull. 1:12. illus.

Parlatoria dives Bellio, 1929. Boll. Lab. Zool. Portici, 22:234, illus.

Syngenaspis theae (Cockerell), Borkhsenius, 1937. Coccidae of quarantine value for U.S.S.R. and related species. U.S.S.R. People's Comissariat for Agriculture, Plant Quarantine Administration, Plant Quarantine Inspection of Georgia, Division of Scientific Literature, p. 88, illus.

Parlatoria theae Cockerell, Morrison, 1939, U.S.-D.A. misc. publ. 344:25, illus.

Parlatoria theae Cockerell, Ferris, 1942, Atlas of Scale Insects, Ser. IV:403.

Parlatoria theae Cockerell, McKenzie, 1945, Microentomology, 10(2):74-75, illus.

Type locality: Originally described from specimens taken in quarantine.

Type host: The variety *viridis* was described from specimens from "ornamental plant" from Japan, taken in quarantine, and the supposed variety *euonymi*, from *Euonymus* from Japan.

Relation to host: Occurring commonly on the twigs of the host. Adult female scale oval, rather flat, grayish-brown, second exuvia almost black or with a greenish tinge and the first exuvia black; male scale elongate, and of essentially the same color as that of adult female.

Additional hosts: *Acer, Aucuba, Bauhinia purpurea, Camellia japonica, Camellia sinensis, Celtis, Citrus, Codiaeum, Cornus, Crataegus, Diospyros, Enkianthus, Eriobotrya, Euonymus, Euphorbia pulcherrima* (Poinsettia), *Hibiscus, Persea, Photinia arbutifolia, Prunus* (apricot, plum, cherry, peach), *Pyracantha, Pyrus, Rosa, Staphylea, Syringa,* and *Viburnum.*

Discussion:

This species is very closely related to *Parlatoria pergandii* Comstock but may be separated by the presence of a derm pocket between posterior spiracle and body margin, and by the normally more numerous perivulvar pores in both anterior and posterior groups.

In California the species does not seem to exhibit aggressive tendencies like *Parlatoria oleae* (Colveé), although when found in nurseries eradication methods are employed to eliminate it.

California records:

Los Angeles Co.: Altadena, XI-19-36 (V. E. Williams). Glendale, V-23-40. Hollywood, V-27-36 (V. E. Williams). Los Angeles, I-8-37. Pasadena, V-11-48 (R. W. Harper). San Gabriel, VII-28-36 (V. E. Williams). San Marino, VI-4-48 (H. M. Armitage, R. W. Harper, and L. E. Myers).

San Diego Co.: Point Loma, II-29-48 (R. W. Harper and K. H. Baker).

Phenacaspis fujicola Kuwana
Fujicola scale
(Fig. 111)

Phecacaspis fujicola Kuwana, 1931. Minist. Agric. Forest. Japan, Sci. Bull. 2:8-9, illus.

Type locality: Angyo, Saitama-ken, Japan.

Type host: *Wistaria chinensis* variety *multijuga.*

Relation to host: Occurring on the leaves. Adult female scale elongate, narrowest in front, rounded posteriorly, somewhat triangular in outline, thin and semitransparent, whitish, with first exuvia grayish-yellow, second exuvia dark brown with yellowish end; male scale elongate, snowy white, sides parallel, exuvia at one end.

Additional hosts: Recorded only from *Wistaria.*

Discussion:

Takahashi (in correspondence) indicates this species is a dimorphic form of *Chionaspis wistariae* Cooley. At present I am inclined to leave the status of *fujicola* unchanged until substantial evidence indicates otherwise.

California records:

This species is very rare in California having been found in only two localities thus far.

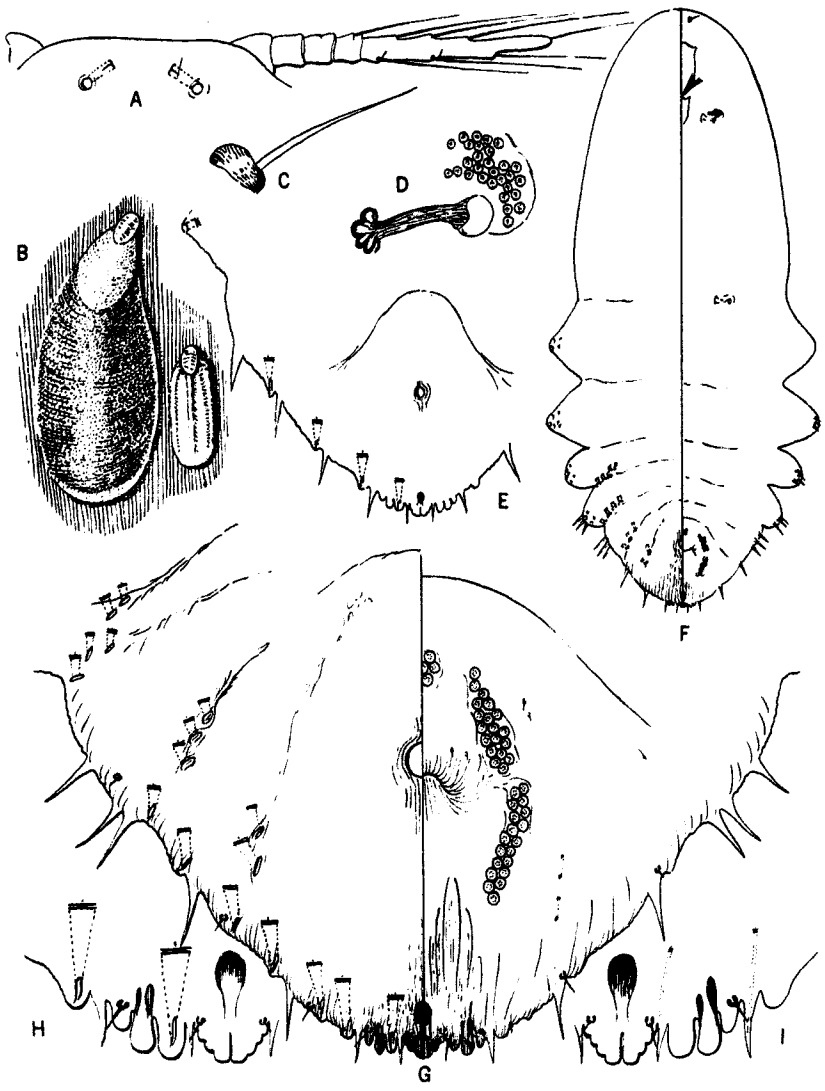

Fig. 114. *Pinnaspis aspidistrae* (Signoret), fern scale.

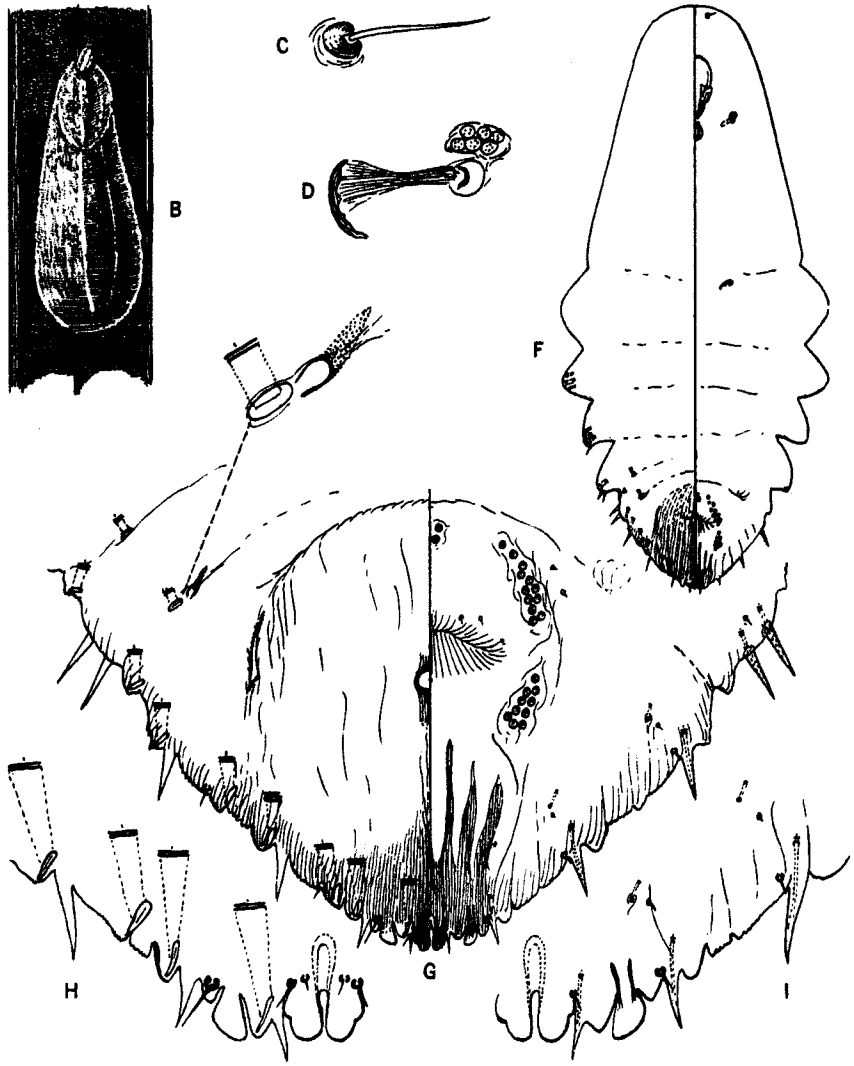

Fig. 115. *Pinnaspis buxi* (Bouché), boxwood scale.

Los Angeles Co.: Inglewood, VIII-27-26 (F. S. Stickney).

San Diego Co.: Chula Vista, X-27-50 (K. H. Baker). Vista, IX-30-54 (G. Becket).

Phenacaspis pinifoliae (Fitch)
Pine needle scale
(Pl. 3, bottom row, center; fig. 112)

Aspidiotus pinifoliae Fitch, 1855. Second Report on the Insects of New York, p. 488.

Mytilaspis pinifoliae (Fitch), Le Baron, 1871. First Report on the Noxious and Beneficial Insects of Illinois, p. 83.

Chionaspis pinifoliae (Fitch), Comstock, 1881, Rep. U.S.D.A. for 1880, p. 318.

Chionaspis pinifolii (Fitch), Riley, 1882, Amer. Nat., 16:514.

Chionaspis pinifoliae variety *semiaurea* Cockerell, 1895, Amer. Nat., 29:731.

Phenacaspis pinifoliae (Fitch), Ferris, 1937. Atlas of Scale Insects, Ser. I:93.

Type locality: New York.

Type host: *Pinus* sp., pine.

Relation to host: Occurring on the needles. Adult female scale usually quite slender, its shape depending somewhat upon the needle width, white, exuviae terminal; male scale elongate, white, exuvia at one end.

Additional hosts: According to published records the species apparently occurring on all species of pine (*Pinus* spp.), and various related hosts such as fir (*Abies* spp.) and spruce (*Picea* spp.). Ferris (1937) reports the species infesting *Pseudotsuga taxifolia*. Records in the California State Department of Agriculture files include *Cedrus deodara*, *Taxus brevifolia*, and *Torreya californica* as additional hosts infrequently attacked.

Discussion:

The occurrence of this scale on members of the Pinaceae (pine family) aids in its determination.

California records:

This species is very common and widespread throughout California. A few of the California records are here listed:

Alameda Co.: Piedmont, V-15-31 (F. J. March).

Butte Co.: Oroville, XI-27-36 (W. L. Stile).

El Dorado Co.: Tahoe Valley (H. H. Keifer).

Los Angeles Co.: Glendale, V-3-38 (V. E. Williams). Los Angeles, IV-4-38 (V. E. Williams).

Monterey Co.: Marina, XI-17-39 (F. J. March).

Nevada Co.: Nevada City, IV-8-41 (J. W. Dixon).

Placer Co.: Auburn, XII-4-36 (F. Clark). Donner Lake, XII-1931 (Milbrath).

Riverside Co.: Arlington, X-14-42 (C. E. Ehmann).

San Bernardino Co.: San Bernardino, VIII-7-41 (C. R. Tower).

San Diego Co.: San Diego, I-7-47 (F. T. Thorne). Sun Crest, XII-26-38 (M. R. Bell).

Santa Cruz Co.: Santa Cruz, VII-22-42 (M. R. Bell).

Stanislaus Co.: Modesto, III-11-41 (J. W. Dixon).

Trinity Co.: Trinity Center, VIII-30-53 (H. H. Keifer).

Tulare Co.: Sequoia National Park, VIII-18-40 (F. G. Lockland).

Tuolumne Co.: Dardanelle, IX-6-36 (H. M. Krebs).

Phenacaspis sandwicensis Fullaway
Oleander scale
(Fig. 113)

Phenacaspis eugeniae (Maskell) variety *sandwicensis* Fullaway, 1932, Proc. Hawaii. Ent. Soc., 8(1):103-104.

Phenacaspis sandwicensis Fullaway, Zimmerman, 1948. Insects of Hawaii, 5:384-386, illus.

Type locality: Hawaii.

Type host: Not indicated.

Relation to host: Occurring on the leaves and fruit. Adult female scale snow-white, pyriform, slightly convex, exuviae terminal, yellowish-brown; male scale elongate, white, felted, and tricarinate. The young scale upon settling produce conspicuous coils of glistening wax threads.

Additional hosts: Zimmerman (1948) records the following hosts of this scale; *Aleurites moluccana*, Bamboo, *Canangium odoratum*, *Cocos nucifera*, *Mangifera indica*, *Moraea bicolor*, *Nerium oleander*, and *Strelitzia regina*.

Discussion:

This species of scale was found infesting *Strelitzia regina* growing in gallon cans in a California nursery. The infested plants originated in Hawaii. Fifty plants were involved in the nursery, and of these, twenty had been sold to retail trade before the infestation was detected. As a result it is assumed that the scale is established in California. The remaining thirty plants have been treated to eradicate the infestation.

This species is very closely allied to *Phenacaspis fujicola* Kuwana, differing from it in possessing mesal paraphyses of the median lobes which are strongly arcuate. *Phenacaspis sandwicensis* is recorded from several hosts, although

never from *Wistaria*, whereas *P. fujicola* is apparently restricted to this host only.

California records:

This species is exceedingly rare in California having been taken only once in a nursery.

Alameda Co.: San Leandro, IX-21-54 (J. V. Lonergan).

Pinnaspis aspidistrae (Signoret)√
Fern scale
(Fig. 114)
(selected references only)

Chionaspis aspidistrae Signoret, 1869, Ann. Soc. ent. Fr., 4(9):443, illus.

Chionaspis brasiliensis Signoret, 1869, Ann. Soc. ent. Fr., 4(9):444.

Chionaspis latus Cockerell, 1896, Psyche, 7, Suppl., p. 53.

Hemichionaspis aspidistrae (Signoret), Cockerell, 1897, Amer. Nat., 31:592.

Chionaspis aspidistrae Signoret, Green, 1899, Coccidae of Ceylon, 2:110, illus.

Hemichionaspis aspidistrae (Signoret), Cooley, 1899. Expt. Sta. Mass. Agric. Coll., Spec. Bull., p. 46, illus.

Chionaspis aspidistrae (Signoret), Newstead, 1901. Monog. of British Coccidae, I:87, illus.

Hemichionaspis aspidistrae (Signoret), Fernald, 1903, Catalogue of Coccidae, p. 239.

Pinnaspis aspidistrae (Signoret), Lindinger, 1912. Die Schildlause, p. 79.

Hemichionaspis aspidistrae (Signoret), MacGillivray, 1921. The Coccidae, p. 343.

Pinnaspis aspidistrae (Signoret), Ferris, 1936, Atlas of Scale Insects, Ser. I:97.

Pinnaspis aspidistrae (Signoret), Lupo, 1938, Boll. Lab. Zool. Portici, 30:300, illus.

Pinnaspis aspidistrae (Signoret), Ferris and Rao, 1947, Micorentomology, 12(2):30-32, illus.

Pinnaspis aspidistrae (Signoret), Zimmerman, 1948. Insects of Hawaii, 5:387, illus.

Type locality: Presumably France.

Type host: *Aspidistra*.

Relation to host: Occurring on the leaves. Adult female scale elongate, quite thick, definitely brown, exuviae terminal; male scale elongate, parallel-sided, white, felted, and bearing three longitudinal ridges.

Additional hosts: Since the original description this species has been recorded from numerous hosts in many parts of the world, especially from plants grown under glass in northern regions. Many of these records are exceedingly doubtful and consequently are not cited here. Ferris and Rao (1947) record the following hosts as authentic for *aspidistrae: Arecastrum romanzoffianum* (= *Cocos plumosa*), *Asplenium*, *Cassia fistula*, *Cassia siamea*, *Citrus*, *Cymbidium*, *Ficus benghalensis*, *Heliconia metallica*, *Mondo*, *Nephrolepis*, *Piper betle*, *Rhapis*, and *Thespesia populnea*.

Discussion:

This species is very similar to *Pinnaspis strachani* (Cooley). The scale of the female is brown in *aspidistrae* and white in *strachani*. In *strachani* the third pair of pygidial lobes are clearly indicated whereas in *aspidistrae* they are only very slightly indicated or completely obsolete.

California records:

This species is a rather common one in California nurseries. A few of the specific localities from where it has been taken are here presented:

Alameda Co.: Berkeley, X-25-43 (G. B. Laing).

Fresno Co.: Fresno, IX-11-47 (J. W. Dixon).

Los Angeles Co.: Gardena, VIII-6-36 (V. E. Williams). Los Angeles, X-20-42 (R. H. Smith). Montebello, X-11-37 (V. E. Williams).

Orange Co.: Anaheim, XI-26-35 (C. E. Norland). Tustin, XI-2-38 (F. Balkam).

Sacramento Co.: Sacramento, VI-10-35 (R. M. LeLong).

San Bernardino Co.: San Bernardino, I-24-47 (W. A. Burr). Upland, IX-18-41 (C. J. Hayward).

San Diego Co.: San Diego, VIII-16-39 (R. R. McLean).

San Francisco Co.: San Francisco, VI-12-41 (J. B. Steinweden).

San Joaquin Co.: Stockton, II-14-41 (J. W. Dixon). Tracy, XI-25-41 (J. B. Steinweden).

San Mateo Co.: Burlingame, I-17-39 (I. J. Campbell).

Santa Cruz Co.: Watsonville, II-20-41 (C. V. Dick).

Solano Co.: Fairfield, VI-29-43 (M. R. Bell).

Stanislaus Co.: Oakdale, IV-6-40 (M. Schrock).

Tulare Co.: Visalia, XI-25-41 (O. L. Hemphill).

Ventura Co.: Camarillo, IX-22-41 (P. B. Travis).

Pinnaspis buxi (Bouché)√
Boxwood scale
(Fig. 115)

Aspidiotus buxi Bouché, 1851, Stettin. ent. Ztg., 12:111.

Mytilaspis (?) *buxi* Bouché, Signoret, 1870, Ann. Soc. ent. Fr., 4(10):93, illus.

Mytilaspis (?) *pandani* Comstock, 1881, Rep. U.S.D.A. for 1880, p. 473, illus. (It appears

safe to presume that the spelling of the specific name is a typographical error for *pandani.*)

Pinnaspis bambusae Cockerell, 1893, Ent. Mon. Mag., 30:157.

Pinnaspis pandani Comstock, Cockerell, 1893, Ent. Mon. Mag., 29:157.

Pinnaspis buxi (Bouché), Newstead, 1901. Monog. British Coccidae, 1:207, illus.

Pinnaspis buxi, (Bouché), Fernald, 1903, Catalogue of Coccidae, p. 242.

Pinnaspis buxi, (Bouché), Leonardi, 1920. Monografia delle Cocciniglie Italiana, p. 179, illus.

Pinnaspis buxi, (Bouché), MacGillivray, 1921, The Coccidae, p. 290.

Pinnaspis siphonodontis Cockerell and Robinson, 1915, Bull. Amer. Mus. Nat. Hist., 34:110, illus.

Hemichionaspis pseudaspidistrae Green, 1916, Bull. Ent. Res., 7:58, illus.

Pinnaspis siphonodontis Cockerell and Robinson, MacGillivray, 1921, The Coccidae, p. 290.

Pinnaspis pandani (Comstock), Lindinger, 1934, Ent. Jahr., 43:164.

Pinnaspis buxi (Bouché), Ferris, 1937, Atlas of Scale Insects, Ser. I:98.

Pinnaspis buxi, (Bouché), Lupo, 1938, Boll. Lab. Zool. Portici, 30:305, illus.

Pinnaspis buxi (Bouché), Ferris and Rao, 1947, Microentomology, 12(2):32-33, illus.

Pinnaspis buxi (Bouché), Zimmerman, 1948. Insects of Hawaii, 5:390, illus.

Type locality: Europe.

Type host: *Buxus sempervirens,* common box.

Relation to host: Occurring chiefly if not entirely on the foliage of its hosts. Adult female scale elongate, expanded posteriorly, pale brown, yellow or white, usually quite thin, flat, and translucent, body of female showing through covering; male scale not known, indicating a probability that the species is parthenogenetic.

Additional hosts: It would appear that *Pandanus* is a preferred host of this species. Ferris and Rao (1947) record it from the following hosts: *Aleurites montana, Anthurium, Artocarpus heterophyllus (=integrifolia), Cassia fistula, Dracaena, Ficus glomerata, Hardwickia binata, Magnolia grandiflora, Michelia champaka, Nerium indicum (=odorum), Punica granatum,* and *Tamarindus indica.*

Discussion:

This species is apparently parthenogenetic since no males are known. The scale is usually white although gradation from this to brown on the same leaves is often observed. The fifth abdominal segment is normally without any dorsal submarginal macroducts, and this character aids in its identification.

This scale is very rare and has been found only in California nurseries and subsequently eradicated through the efforts of the California State Nursery Service.

California records:

Alameda Co.: Oakland, IV-24-47 (J. F. Gallagher).

San Francisco Co.: San Francisco, II-15-35 (J. B. Steinweden and F. J. March).

Pinnaspis strachani (Cooley)
Lesser snow scale
(Fig. 116)

Hemichionaspis minor strachani Cooley, 1899. Expt. Sta. Mass. Agric. Coll., Spec. Bull., p. 54, illus.

Hemichionaspis marchali Cockerell, 1902, Bull. Soc. ent. Fr., 71:82.

Hemichionaspis minor strachani Cooley, Fernald, 1903, Catalogue of Coccidae, p. 241.

Hemichionaspis marchali Cockerell, Fernald, 1903, Catalogue of Coccidae, p. 240.

Hemichionaspis minor strachani Cooley, Kuwana, 1903, Proc. Calif. Acad. Sci., 3(3):75.

Hemichionaspis townsendi Cockerell, 1905, Proc. Davenport Acad. Sci., 10:135.

Hemichionaspis aspidistrae variety *gossypii* Newstead, 1908, Jour. Econ. Biol., 3:37.

Pinnaspis temporaria Ferris, 1942, Atlas of Scale Insects, Ser. IV:407.

Pinnaspis marchali (Cockerell), Hall, 1946, Trans. Roy. Ent. Soc. London, 97:529.

Pinnaspis gossypi (Newstead), Hall, 1946, Trans. Roy. Ent. Soc. London, 97:529, illus.

Pinnaspis strachani (Cooley), Ferris and Rao, 1947, Microentomology, 12(2):39-41, illus.

Type locality: Abeokuta in Egbaland, West Africa.

Type host: Undetermined.

Relation to host: Commonly occurring on the twigs, although on some hosts it infests leaves, and on palms it may occur on the leaves, fruits, or husks. Adult female scale white, opaque, elongate, and moderately broad, exuviae terminal; male scale white, felted, strongly tricarinate, exuvia at one end.

Additional hosts: Ferris and Rao (1947) list the following species as hosts of *strachani: Acacia melanoxylon, Antigonon, Asparagus officinalis, Attalea* sp., *Cassia, Citrus, Cocos nucifera, Cycas revoluta, Cypripedium, Dodonaea viscosa, Elaeis guineensis,* Fabaceous shrub, *Ficus, Gossypium,* Malvaceous plant, *Mangifera indica,* mistletoe, *Ochroma* sp., *Sapindus,* and *Trichosanthes.*

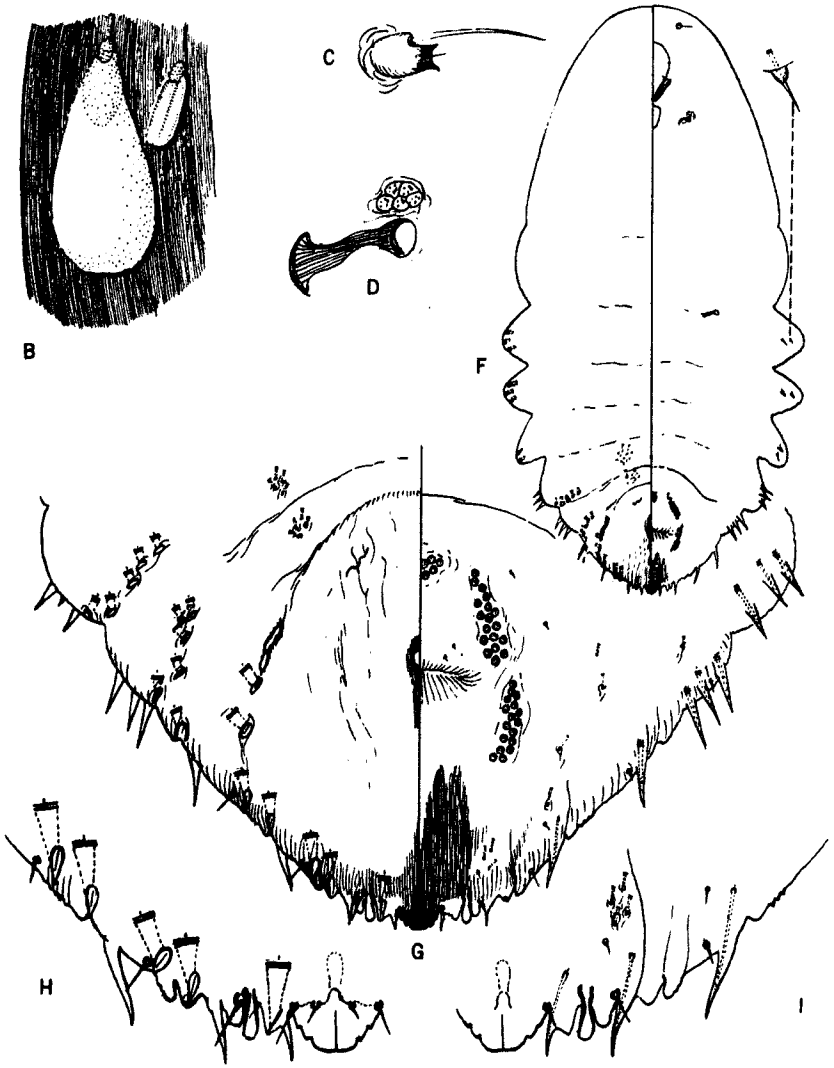

Fig. 116. *Pinnaspis strachani* (Cooley), lesser snow scale.

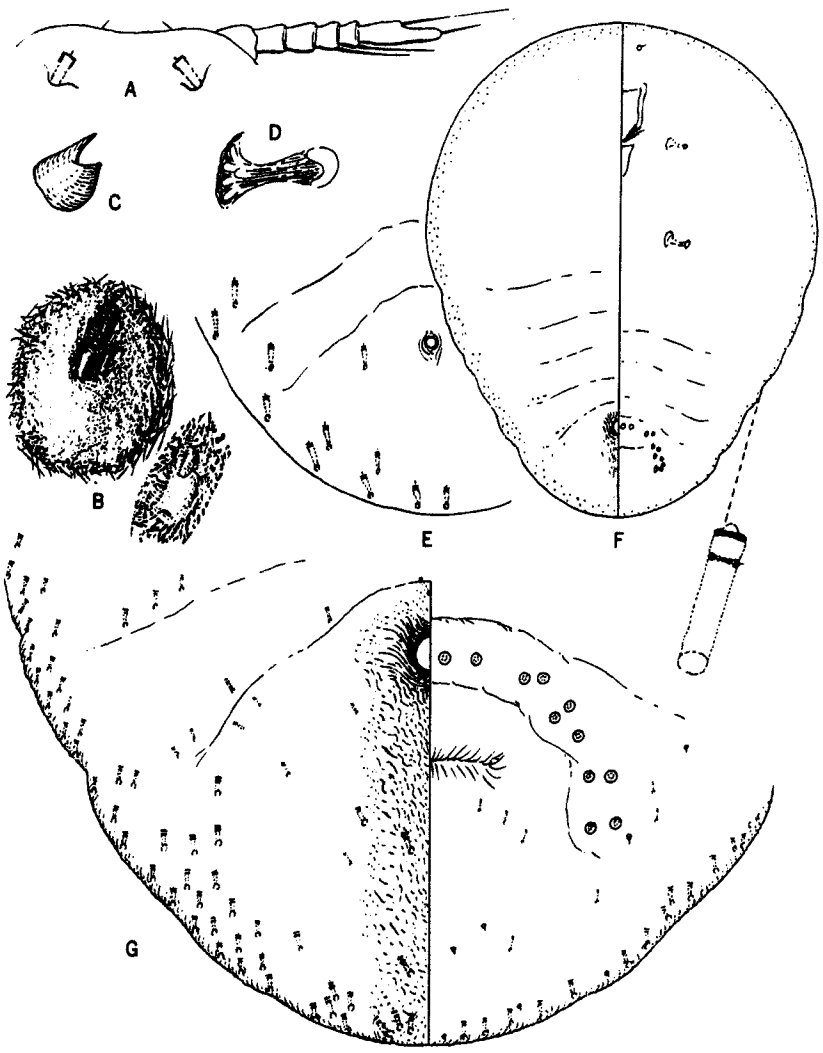

Fig. 117. *Protodiaspis agrifoliae* Essig, oak protodiaspis scale.

Host records of the California State Department of Agriculture include *Cymbidium, Dracaena, Hibiscus, Saintpaulia,* and *Sansevieria.*

Discussion:

This is the "lesser snow scale" of economic entomologists. The species has been found in California nurseries several times particularly on *Sansevieria,* ferns, and cycads. When discovered it is subjected to rigid eradication.

The species is rather closely related to *Pinnaspis aspidistrae* (Signoret), but differs from it in having a scale which is normally white or gray, whereas that of *aspidistrae* is brown.

California records:

Alameda Co.: Berkeley, II-6-48 (W. S. Sibray). Oakland, I-16-51 (W. S. Sibray and R. P. Allen).

Kern Co.: Bakersfield, III-18-48 (J. W. Stockton).

Los Angeles Co.: Los Angeles, X-24-47 (L. E. Myers). Pasadena, IX-22-36 (V. E. Williams). West Los Angeles, X-24-47 (L. E. Myers).

Riverside Co.: Palm Springs, X-8-47 (C. Whitbeck).

San Bernardino Co.: Chino, XI-26-48 (W. Burr). Ontario, XI-17-49 (R. F. Camblin).

San Francisco Co.: San Francisco, IX-18-44 (M. R. Bell).

San Mateo Co.: South San Francisco, IV-30-53 (C. E. Bridges).

Santa Barbara Co.: Santa Barbara, XII-23-47 (R. W. Harper).

Santa Clara Co.: Palo Alto, X-16-52 (G. F. Prole).

Ventura Co.: Oxnard, IX-16-53 (C. May).

Protodiaspis agrifoliae Essig
Oak protodiaspis scale
(Fig. 117)

Protodiaspis agrifolia Essig, 1914, Pomona Coll. Jour. Ent. Zool., 6(2):76-80, illus.

Essigaspis agrifoliae (Essig), MacGillivray, 1921, The Coccidae, p. 324.

Protodiaspis agrifoliae Essig, Ferris, 1937, Atlas of Scale Insects, Ser. I:100.

Type locality: Near Santa Paula, Ventura County, California.

Type host: *Quercus agrifolia,* coast live oak.

Relation to host: Occurring exposed upon the twigs and leaves of the host. Adult female scale imbedded in leaf hairs, rather thick and brittle, light gray to blackish, exuviae comparatively large, terminal; male scale likewise imbedded in leaf hairs, elongate, whitish to gray, exuvia yellowish, terminal.

Additional hosts: Apparently recorded only from *Quercus agrifolia.*

Discussion:

The specificity of this scale on *Quercus,* together with no vestiges of pygidial lobes, tends to distinguish this scale from all other California diaspidids.

California records:

Los Angeles Co.: Claremont, I-17-14 (E. O. Essig).

San Diego Co.: Buckman Springs, III-1939 (G. F. Ferris).

Ventura Co.: Santa Paula (near), 1910 (S. H. Essig).

Pseudaulacaspis pentagona (Targioni)
White peach scale
(Fig. 118)

Diaspis pentagona Targioni, 1886, Riv. Bachcoltura, 18(11).

Diaspis amygdali Tryon, 1889, Report on Fungous Pests, p. 89.

Diaspis lanatus Morgan and Cockerell, 1892, Jour. Inst. Jamaica, 1:137.

Diaspis patelliformis Sasaki, 1894. Bull. Agric. Coll., Univ. Tokio, p. 107.

Chionaspis prunicola Maskell, 1894, Trans. N.Z. Inst., 27:49.

Diaspis amygdali variety *rubra* Maskell, 1898, Trans. N.Z. Inst., 30:228.

Aulacaspis pentagona (Targioni), Fernald, 1903, Catalogue of Coccidae, p. 234.

Saskiaspis pentagona (Targioni), Kuwana, 1926. The Diaspine Coccidae of Japan IV, p. 9, illus.

Pseudaulacaspis pentagona (Targioni), Ferris, 1937, Atlas of Scale Insects, Ser. I:109.

Type locality: Province of Como, Italy.

Type host: *Morus* sp., mulberry.

Relation to host: Occurring on the bark, leaf, and fruit. Adult female scale white, subcircular, the exuviae near the margin; male scale elongate, white, and noncarinate.

Additional hosts: This species has been recorded from a long series of hosts including such diverse species as *Catalpa,* fern, *Ficus, Fraxinus, Hibiscus esculentus, Hibiscus* spp., *Juglans, Ligustrum, Morus, Phoenix, Populus, Prunus persica, Ricinus communis,* and *Syringa.*

Discussion:

This is the "white peach scale" of economic entomologists. The body form of the adult female is broadly oval, and the margins are strongly lobed. It is the only species of this genus represented in North America.

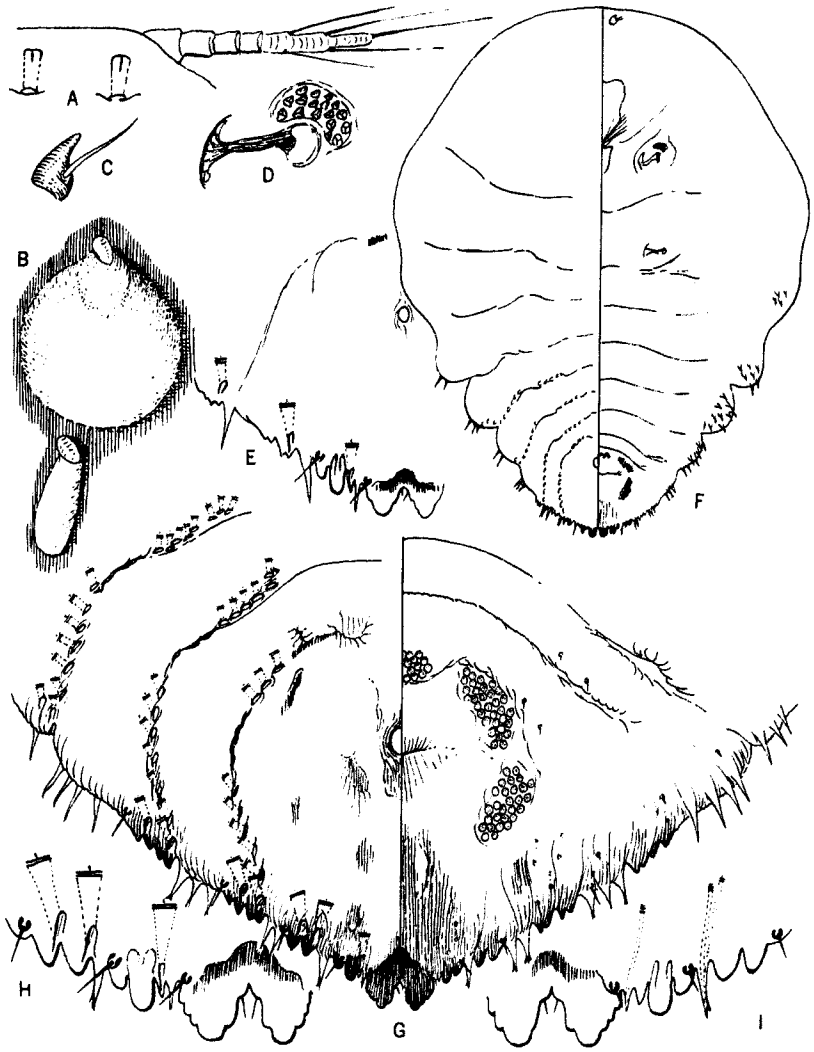

Fig. 118. *Pseudaulacaspis pentagona* (Targioni), white peach scale.

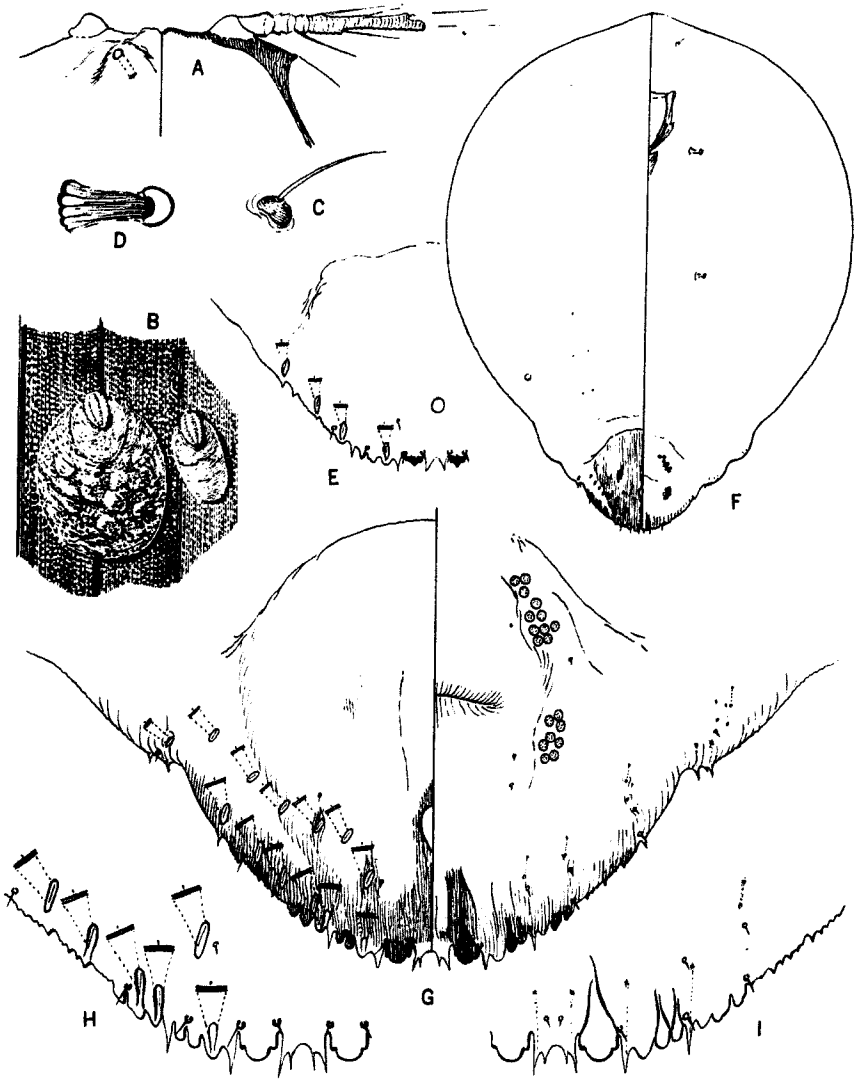

Fig. 119. *Pseudoparlatoria parlatorioides* (Comstock), false parlatoria scale.

California records:

Los Angeles Co.: Pasadena, III-1918 (R. W. Doane).

Sacramento Co.: Sacramento, 1919 (H. S. Smith).

Pseudoparlatoria parlatorioides (Comstock)
False parlatoria scale
(Fig. 119)

Aspidiotus (?) *parlatorioides* Comstock, 1883, 2d Rep. Dept. Ent. Cornell Univ., p. 64, illus.

Pseudoparlatoria pusilla Green, 1922, Jour. Bombay Nat. Hist. Soc., 28:1010, illus.

Pseudoparlatoria parlatorioides (Comstock), Ferris, 1942, Atlas of Scale Insects, Ser. IV:417.

Type locality: Fort George, Florida.

Type host: *Persea borbonia* (avocado).

Relation to host: Occurring principally on the leaves. Adult female scale flat, thin, and semitransparent, of a yellow or yellowish-brown color, circular or oval, exuviae at one end; male scale elongate, similar in color and texture to that of adult female, exuvia terminal.

Additional hosts: This species has been recorded from a long list of hosts a few of which are: *Acalypha, Bignonia, Camellia, Cestrum, Cinnamomum, Coleus, Cypripedium, Dianthus caryophyllus, Erythrina,* fern, *Ficus, Gaylussacia, Hedera helix, Hibiscus, Ilex, Ixora, Jacobinia, Jasminum, Magnolia, Nerium oleander, Olea europaea,* orchid (several genera), palm (several genera), *Psidium,* and *Sabal.*

Discussion:

This scale is known to California economic etomologists as the "false parlatoria scale." The transparent nature of the scale covering, together with the widely separated median pygidial lobes with a forked gland spine between, and the paucity of the dorsal macroducts, serves as distinguishing characteristics of this scale.

The scale is occasionally found in California nurseries infesting especially phoenix palms and cypripedium orchids.

California records:

Alameda Co.: Berkeley, III-16-42 (P. C. Ting and R. C. Clemens). Oakland, IX-26-47 (W. S. Sibray).

Los Angeles Co.: West Los Angeles, VI-20-41 (J. B. Steinweden).

Marin Co.: Belvedere, XII-15-50 (E. Cowen). Larkspur, XII-28-43 (M. R. Bell).

Quernaspis quercus (Comstock)
Oak scale
(Fig. 120)

Chionaspis quercus Comstock, 1881, Rep. U.S.-D.A. for 1880, p. 319.

Fundaspis quercus (Comstock), MacGillivray, 1920, The Coccidae, p. 338.

Quernaspis quercus (Comstock), Ferris, 1937, Atlas of Scale Insects, Ser. I:119.

Type locality: San Fernando Valley, Los Angeles County, California.

Type host: *Quercus lobata,* California white oak.

Relation to host: Occurring on the bark. Adult female scale grayish-white, elongate, broader, and rounded at one end, narrowed at other, exuviae terminal; male scale smaller, elongate, whitish, and slightly carinated.

Additional hosts: Recorded only from various oaks, *Quercus* spp., and *Lithocarpus densiflorus* (tan oak).

Discussion:

The fused median pygidial lobes, the noticeable scleroses surrounding the marginal ducts, and the scattered dorsal pygidial macroducts and host specificity easily distinguish this species from other California diaspidids.

California records:

Butte Co.: Chico, II-10-45 (R. G. White).

El Dorado Co.: Shingle Springs, IX-1-42 (H. L. McKenzie and H. H. Keifer).

Los Angeles Co.: Canoga Park, III-16-34 (V. E. Williams). Puente, IV-17-40.

Sacramento Co.: North Sacramento, II-15-47 (J. B. Steinweden).

San Diego Co.: Flynn Springs, VI-23-34 (E. T. Gammon and C. Gammon). San Diego, VII-25-34 (C. Osborn).

San Luis Obispo Co.: Paso Robles, IV-4-52 (R. M. Hawthorne).

Ventura Co.: Ojai Valley, VIII-4-38 (R. Young).

Situlaspis atriplicis (Ferris)
Atriplex scale
(Fig. 121)

Pseudodiaspis atriplicis Ferris, 1919, Stanford Univ. Publ., Univ. Ser., p. 53, illus.

Situlaspis atriplicis (Ferris), Ferris, 1937, Atlas of Scale Insects, Ser. I:121.

Type locality: Tempe, Arizona.

Type host: *Atriplex* sp.

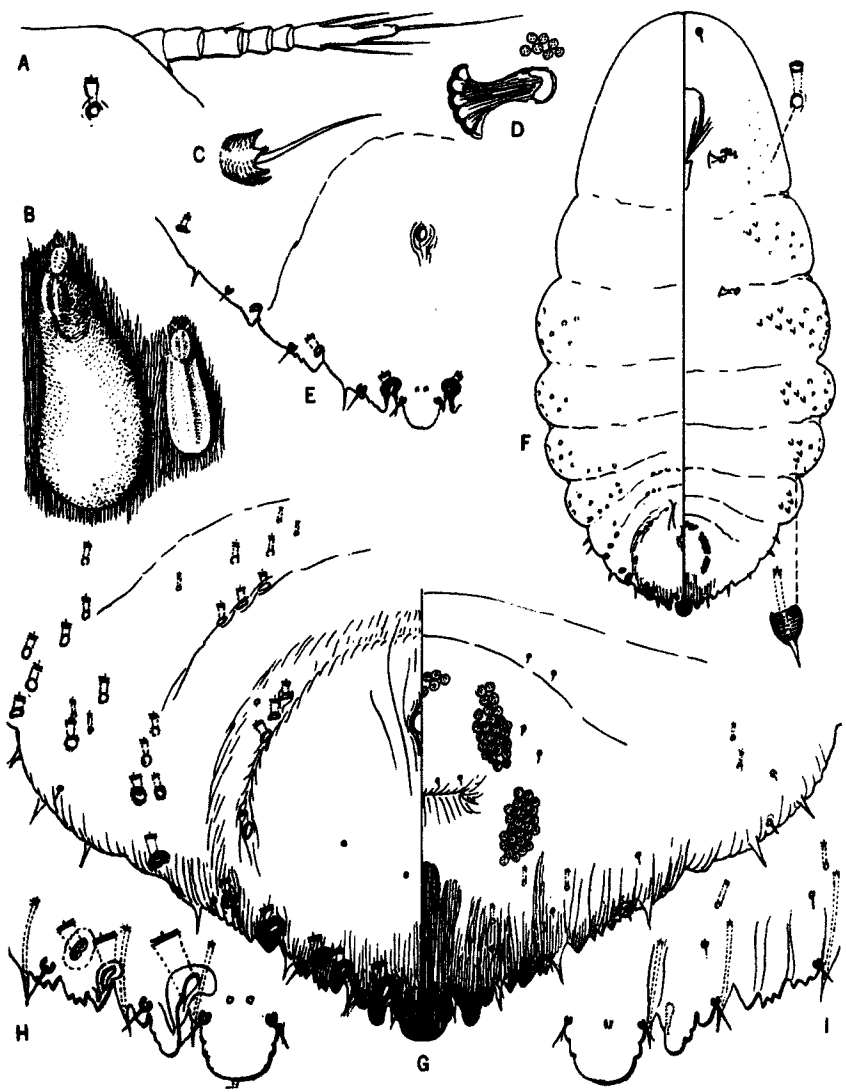

Fig. 120. *Quernaspis quercus* (Comstock), oak scale.

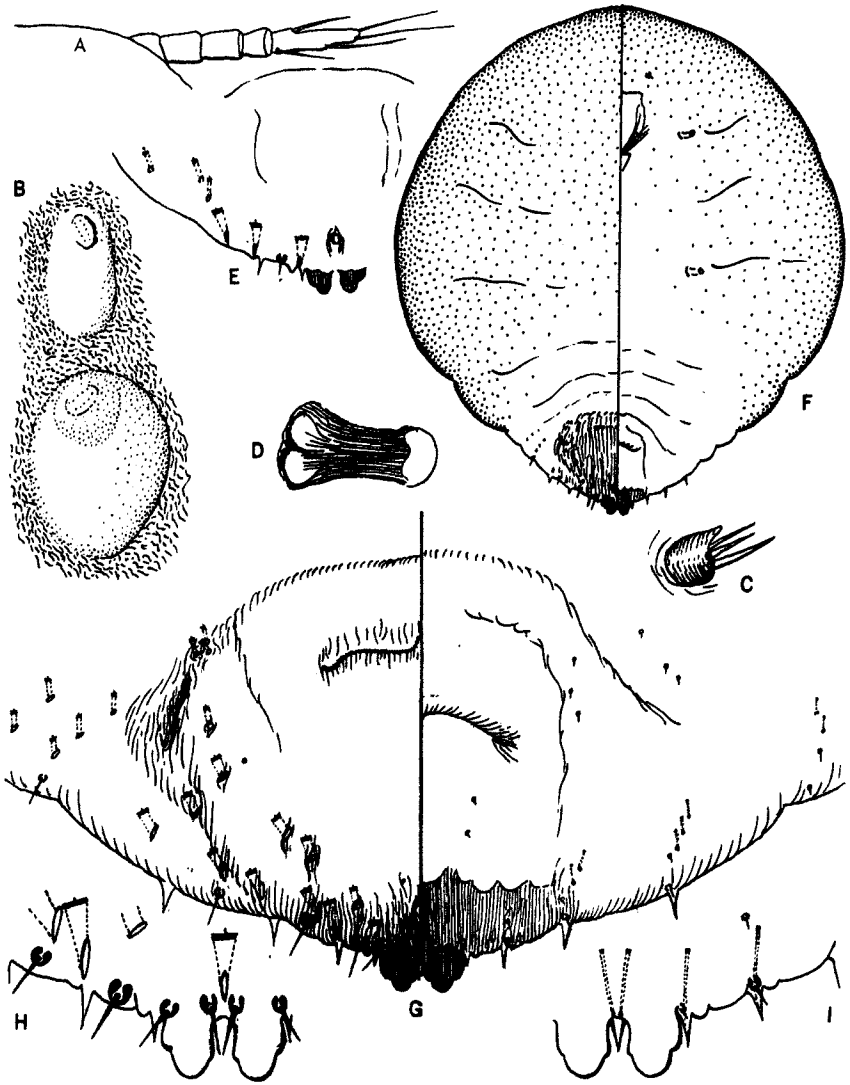

Fig. 121. *Situlaspis atriplicis* (Ferris), Atriplex scale.

Relation to host: Occurring on the leaves and small twigs, Adult female small (scarcely 1 mm. in diameter), white, circular, convex, exuviae subcentral; male scale similar to adult female in color and texture, elongate, exuvium terminal.
Additional hosts: Recorded only from *Atriplex* sp.
Discussion:

This species approaches most closely *Situlaspis yuccae* (Cockerell) from which it is easily distinguishable by its form and by the smaller anal opening situated in a different position.
California records:

Los Angeles Co.: Palmdale, XI-1-34 (G. Murphy).

Riverside Co.: Desert Center, III-29-39 (G. F. Ferris).

Situlaspis daleae Ferris
Dalea scale
(Fig. 122)

Situlaspis daleae Ferris, 1941, Atlas of Scale Insects, Ser. III:320.
Type locality: Indio (foot of mountains to north), Riverside County, California.
Type host: *Dalea* sp.
Relation to host: Occurring on the small twigs, in axils, and beneath bracts. Adult female scale roughly circular, irregular according to its surroundings, quite high, convex, white, exuviae central or subcentral and black; male scale not recognized.
Additional hosts: Recorded only from *Dalea* sp.
Discussion:

This species is a member of the genus *Situlaspis*, a group that seems confined to the desert regions of southwestern United States, and northwestern Mexico. It is known only from the type lot.
California records:

Riverside Co.: Indio, III-1912 (J. C. Bridwell).

Situlaspis multipora (Ferris)
Mistletoe situlaspis scale
(Fig. 123)

Pseudodiaspis multipora Ferris, 1919, Ent. News, 30:275-276, illus.
Pseudodiaspis multipora Ferris, 1921, Stanford Univ. Publ., Univ. Ser., 1(2):101.
Situlaspis multipora (Ferris), 1937, Atlas of Scale Insects, Ser. I:123.
Type locality: Julian, San Diego County, California.
Type host: *Phoradendron flavescens* (mistletoe on oak).
Relation to host: Occurring on the stems, generally partly concealed beneath any bark irregularities. Adult female white, circular, convex, exuviae subcentral, ventral scale quite thick; male scale elongate, white, exuvium terminal.
Additional hosts: Recorded only from mistletoe.
Discussion:

This scale is apparently quite rare in California. Ferris (1937) states that "this species is referred with some doubt to *Situlaspis*, although the only precise character which might justify its generic separation is the absence of the usual marginal ducts in the intersegmental areas of the pygidium."
California records:

San Diego Co.: Hauser Canyon, Marino Dam, XII-17-52 (R. F. Wilkey). Jacumba, XII-4-51 (G. W. Schwegel). Julian, (herbarium specimen).

Situlaspis yuccae (Cockerell)
Small situlaspis scale
(Fig. 124)

Aspidiotus yuccae Cockerell, 1896, Psyche, 7(1):20.
Aspidiotus yuccae variety *neomexicana* Cockerell, 1898, Ann. Mag. Nat. Hist., 7(2):25.
Diaspis celtidis Cockerell, 1899, Canad. Ent., 31:106.
Xerophilaspis parkinsoniae Cockerell, 1899, Arizona Expt. Sta., Bull. 32, p. 282.
Targionia yuccae (Cockerell), Fernald, 1903, Catalogue of Coccidae, p. 298.
Pseudodiaspis parkinsoniae (Cockerell), Ferris, Stanford Univ. Publ., Univ. Ser., p. 56, illus.
Pseudodiaspis yuccae (Cockerell), Ferris, 1920, Canad. Ent., 52:64.
Neosignoretia yuccae (Cockerell), MacGillivray, 1921, The Coccidae, p. 424.
Situlaspis yuccae (Cockerell), Ferris, 1937, Atlas of Scale Insects, Ser. I:125.
Type locality: Ciudad Porfirio Diaz (=Juarez), Mexico.
Type host: *Yucca* sp.
Relation to host: Occurring predominately on the stems, although occasionally on leaf bases. Adult female scale quite small, not more than 1 mm. long, white, oval, flat, and with a large dark central exuviae; male scale white, elongate oval, exuvium terminal.
Additional hosts: Recorded from many hosts some of which are: *Acacia, Cercidium, Condalia, Fraxinus,* grass, *Larrea, Olea, Porliera, Ribes, Robinia, Rosa, Simmondsia, Spiraea, Symphoricarpos, Syringa,* and *Vitis.*

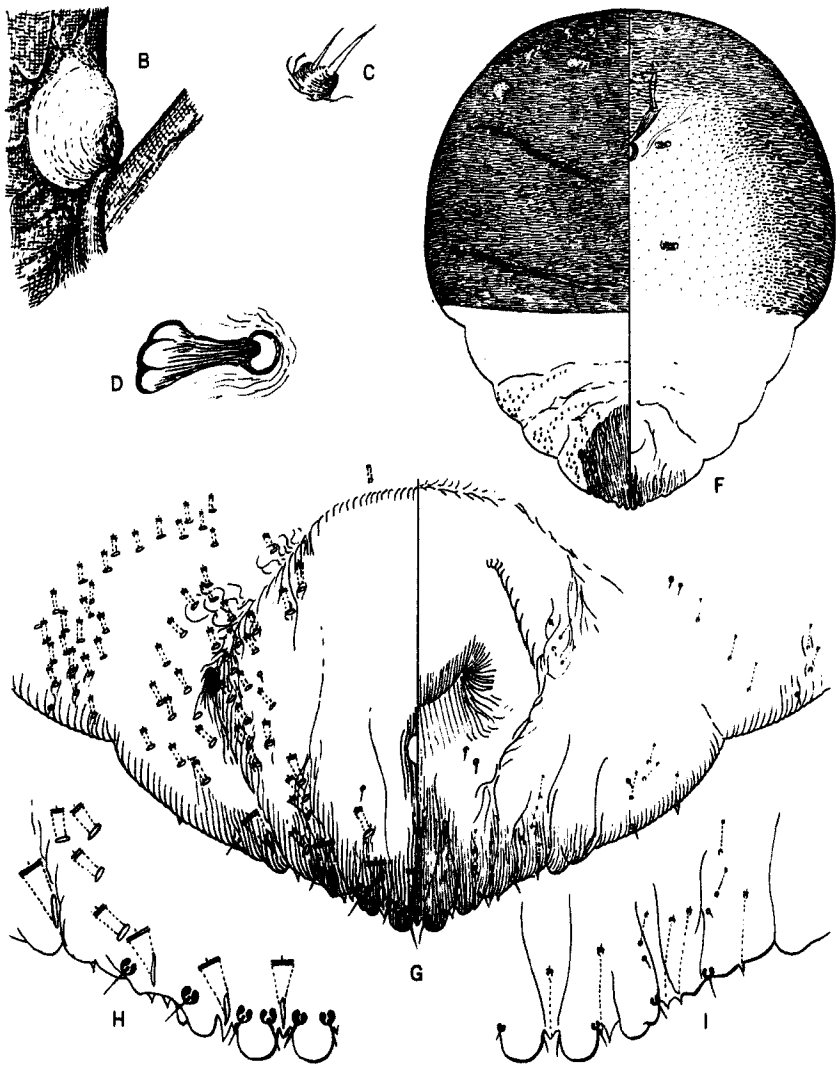

Fig. 122. *Situlaspis daleae* Ferris, Dalea scale.

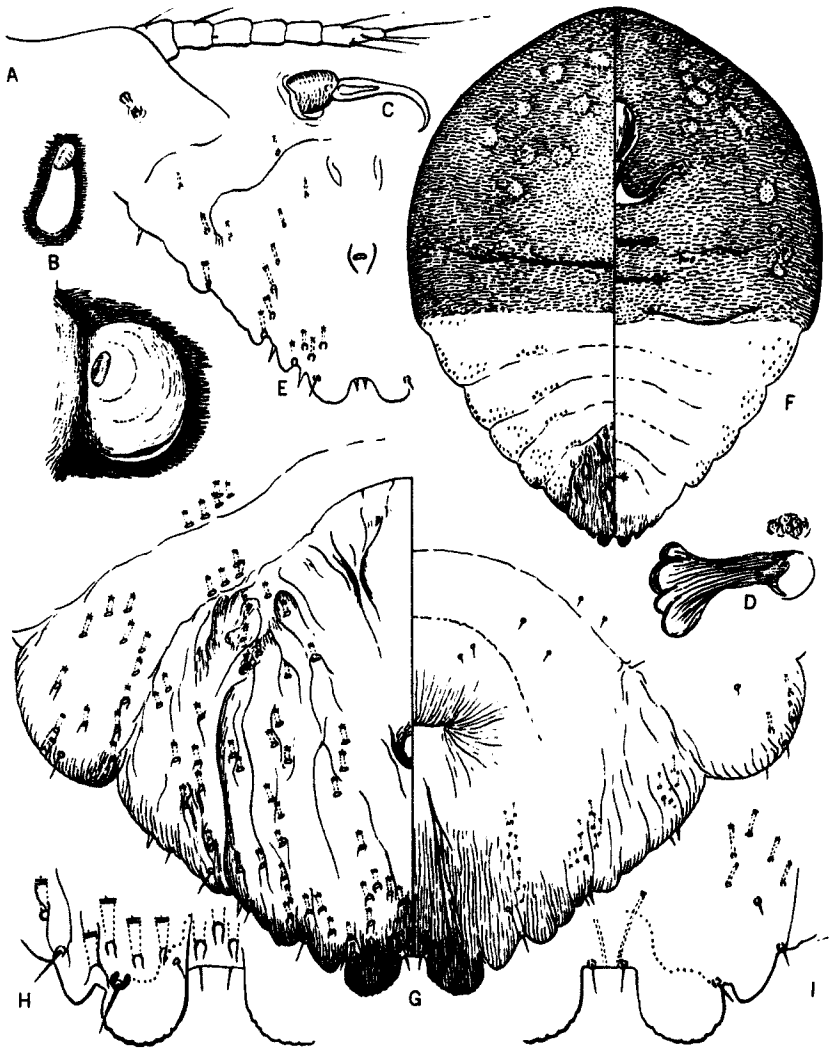

Fig. 123. *Situlaspis multipora* (Ferris), mistletoe situlaspis scale.

Discussion:

This is an exceedingly small species, measuring little more than 0.6 mm. in length in mounted examples. The species is closely related to *Situlaspis atriplicis* (Ferris), but differs in having a more elongate oval body form, and much larger anal opening which is further removed from pygidial lobes than is the case of *atriplicis*. Perivulvar pores present or absent. In some specimens they are vestigal, being little larger than seta bases; in others they may show on one side of body and not on the other; not more than four or five pores on either side.

California records:

Butte Co.: Fairmont, IX-30-51 (H. H. Keifer).

Imperial Co.: Calexico, I-12-45 (A. J. Hansen and C. G. Anderson). El Centro, III-8-50 (C. R. Tower).

Inyo Co.: Lone Pine, VIII-29-46 (J. W. Dixon).

Kern Co.: Bakersfield, III-10-49 (R. W.. Harper and C. S. Morley). Ford City, III-3-42 (T. B. Gallion).

Kings Co.: Lemoore, VIII-14-41 (T. B. Gallion).

Orange Co.: Anaheim, II-17-32.

San Bernardino Co.: Needles, XI-4-41 (G. A. Pohl and A. E. Breech).

San Diego Co.: San Felipe Valley, III-22-49 (P. C. Ting). Sentenac Canyon, V-14-49 (F. L. Blanc).

Tulare Co.: Porterville, XI-29-50 (O. L. Hemphill).

Ventura Co.: Pine, X-28-47 (J. Allee).

Stramenaspis kelloggi (Coleman)
Kellogg scale
(Fig. 125)

Leucaspis kelloggi Coleman, 1903, Jour. N.Y. Ent. Soc., 11:68, illus.

Dinaspis kelloggi (Coleman), Ferris, 1920, Stanford Univ. Publ., Univ. Ser., Biol. Sci., 1(1):47, illus.

Suturaspis kelloggi (Coleman), MacGillivray, 1921, The Coccidae, p. 268.

Stramenaspis kelloggi (Coleman), Ferris, 1937, Atlas of Scale Insects, Ser. I:127.

Type locality: Various localities in northern California.

Type host: *Pseudotsuga taxifolia* and *Abies* spp.

Relation to host: Occurring on the foliage. Adult female scale elongate and slender, straw-colored, exuviae apical; male scale similar but much smaller, exuvium terminal.

Additional hosts: In addition to *Pseudotsuga taxifolia* and *Abies* spp., the species has been recorded from several different species of *Pinus*.

Discussion:

The generic name of this species refers to the straw-colored scale. The host specificity of *kelloggi* on members of the pine family (Pinaceae) aids in the determination of this scale. The scale covering may be easily distinguished from that of *Phenacaspis pinifoliae* (Fitch), which occurs on the same hosts, by its straw color, that of *pinifoliae* being snowy white.

California records:

Alameda Co.: Piedmont, II-8-54 (W. A. Kroger).

Los Angeles Co.: Arcadia, II-21-53 (R. F. Wilkey). Pasadena, I-15-33 (L. E. Myers). Pomona, VIII-30-49 (R. W. Harper).

Mariposa Co.: Yosemite.

Mendocino Co.: Various localities: VII-1901 (G. A. Galewen).

Monterey Co.: Tassajara Hot Springs (G. F. Ferris).

Santa Clara Co.: San Jose, VIII-31-54 (G. F. Prole). Stanford University (arboretum), XII-15-01 (G. A.. Coleman).

Siskiyou Co.: Dunsmuir, VIII-25-01 (G. A. Coleman).

Unaspis euonymi (Comstock)
Euonymus scale
(Pl. 3, bottom row, right; fig. 126)

Chionaspis euonymi Comstock, 1881, Rep. U.S.-D.A. for 1880, p. 313, illus.

Chionaspis euonymi Comstock, Lindinger, 1912. Die Schildlause, p. 146.

Chionaspis euonymi Comstock, Leonardi, 1920. Monogragia delle Cocciniglie Italiane, p. 226, illus.

Chionaspis euonymi Comstock, MacGillivray, 1921. The Coccidae, p. 325.

Unaspis euonymi (Comstock), Ferris, 1937, Atlas of Scale Insects, Ser. I:130.

Unaspis nakayamai Takahashi and Kanda, 1939, Annot. zool. jap., 18:185.

Unaspis euonymi (Comstock), McKenzie, 1947, Calif. Dept. Agric. Bull., 36(1):32.

Unaspis euonymi Comstock, Cantelo, 1953, Agric. Expt. Sta., Univ. Mass., Bull. 471:1-31, illus.

Type locality: Norfolk, Virginia.

Type host: *Euonymus latifolius*.

Relation to host: Occurring on leaves and stems. Adult female scale dark-brown or purplish-brown, broad, and flattened, generally with a

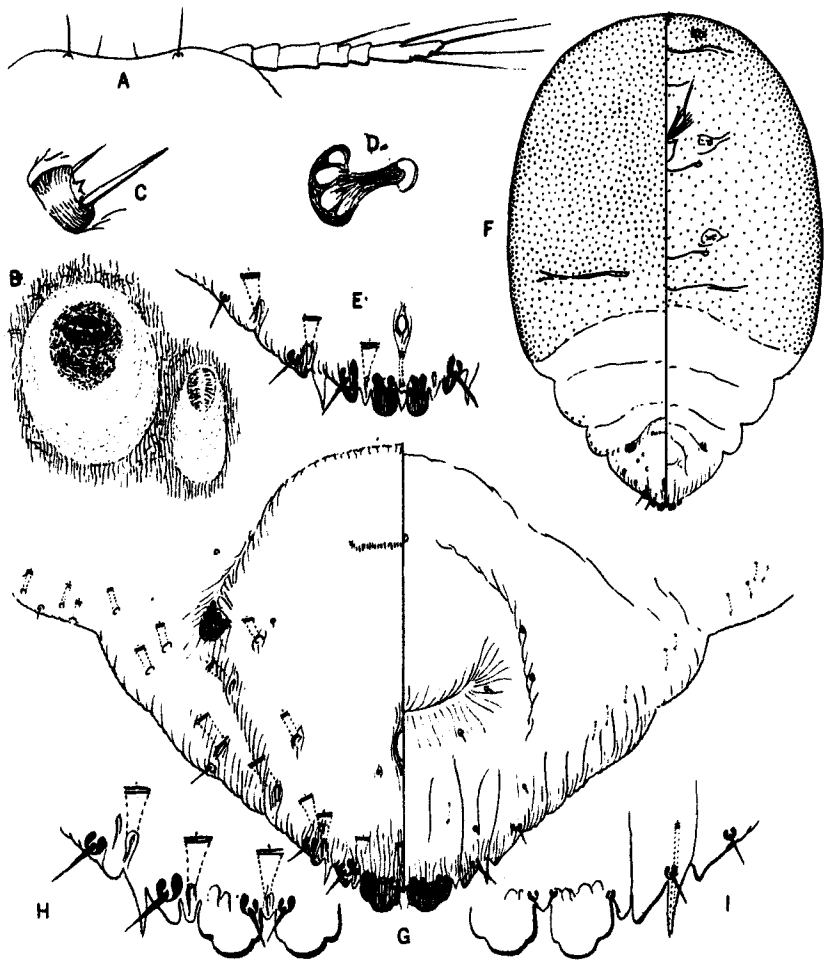

Fig. 124. *Situlaspis yuccae* (Cockerell), small situlaspis scale.

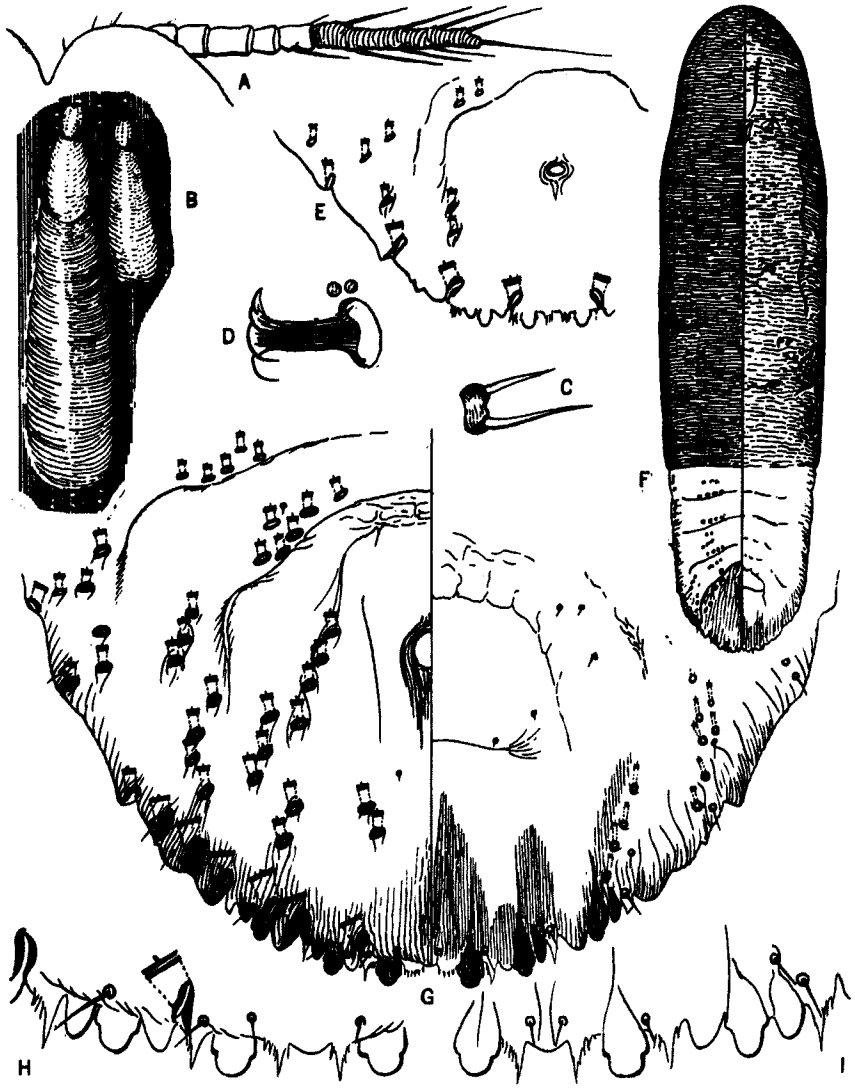

Fig. 125. *Stramenaspis kelloggi* (Coleman), Kellogg scale.

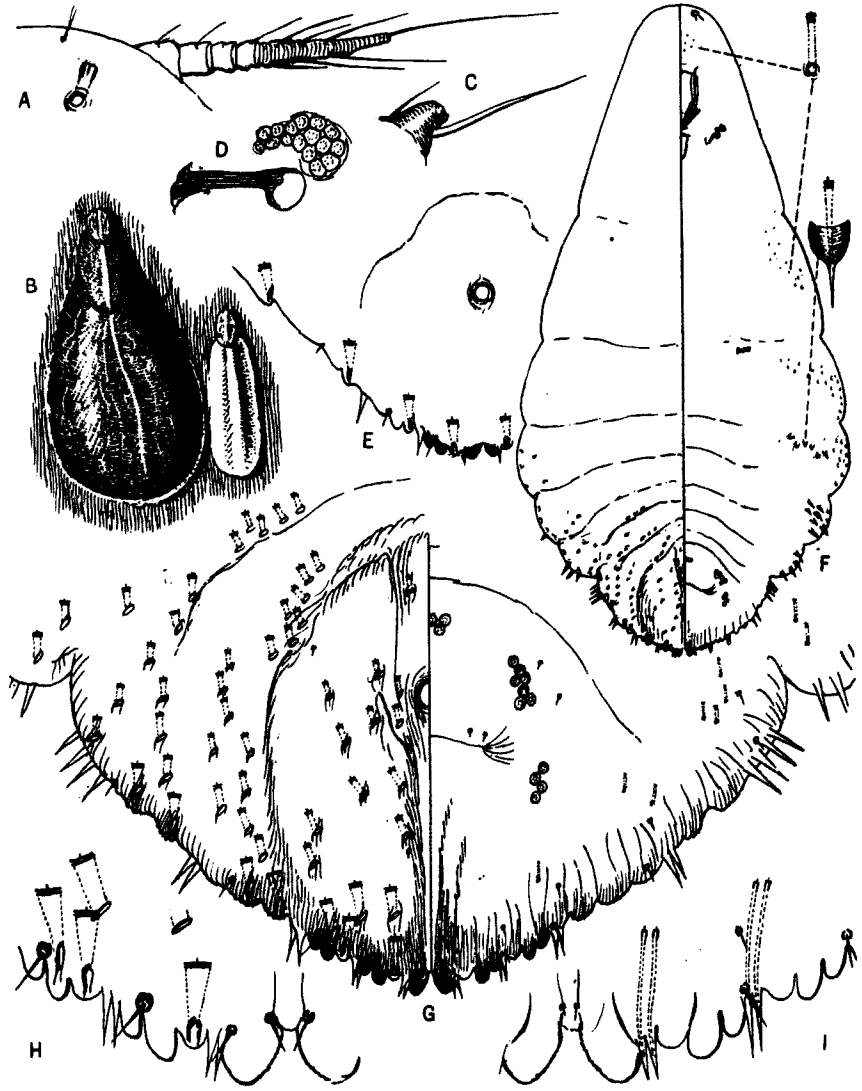

Fig. 126. *Unaspis euonymi* (Comstock), Euonymus scale.

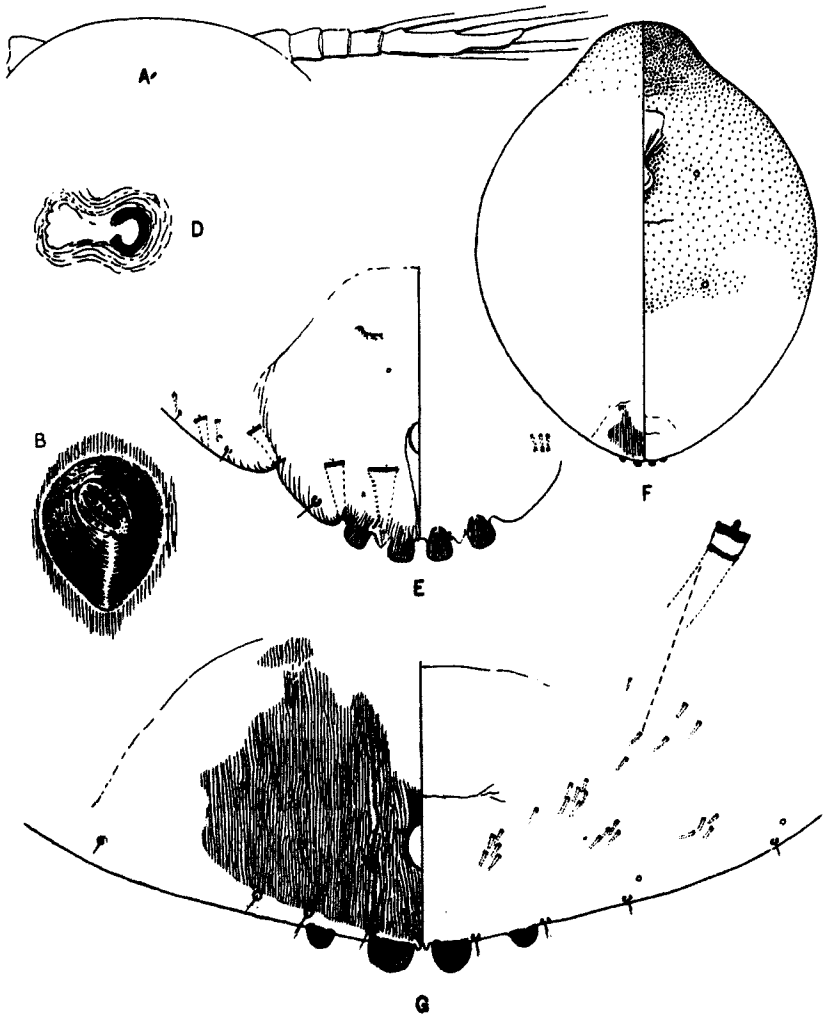

Fig. 127. *Xerophilaspis prosopidis* (Cockerell), mesquite scale.

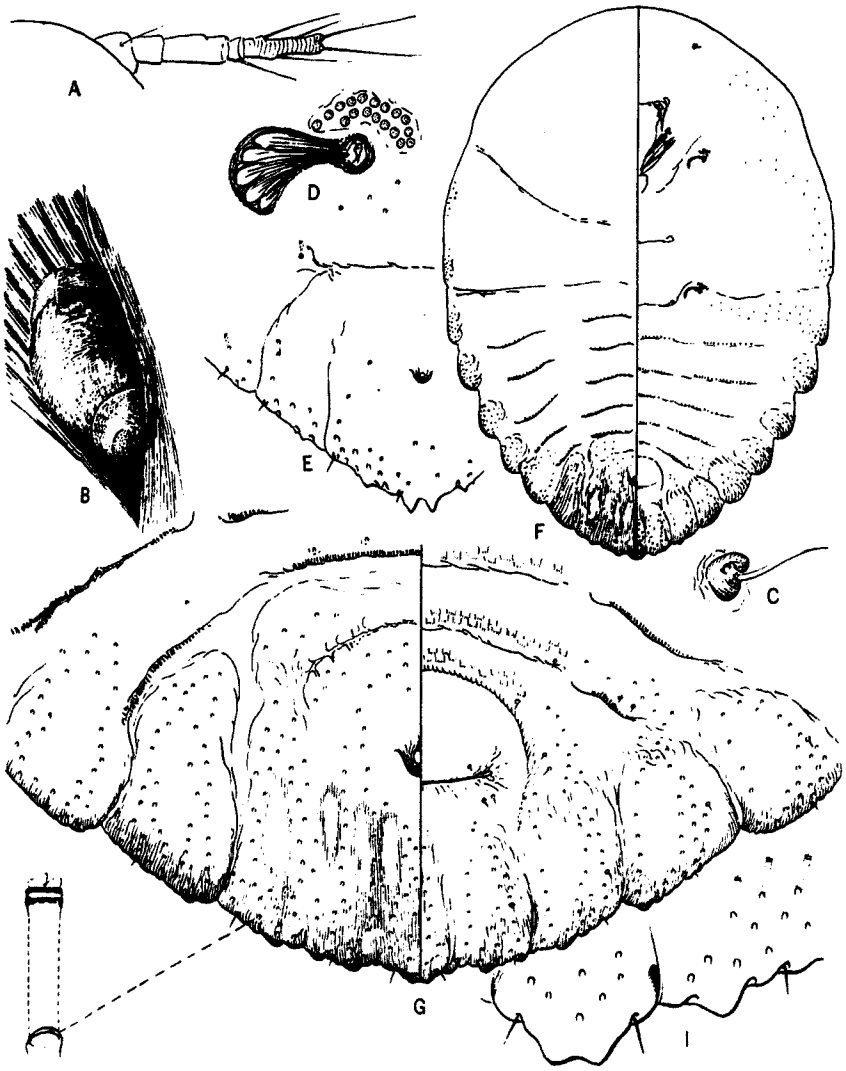

Fig. 128. *Odonaspis graminis* Bremner, grass root scale.

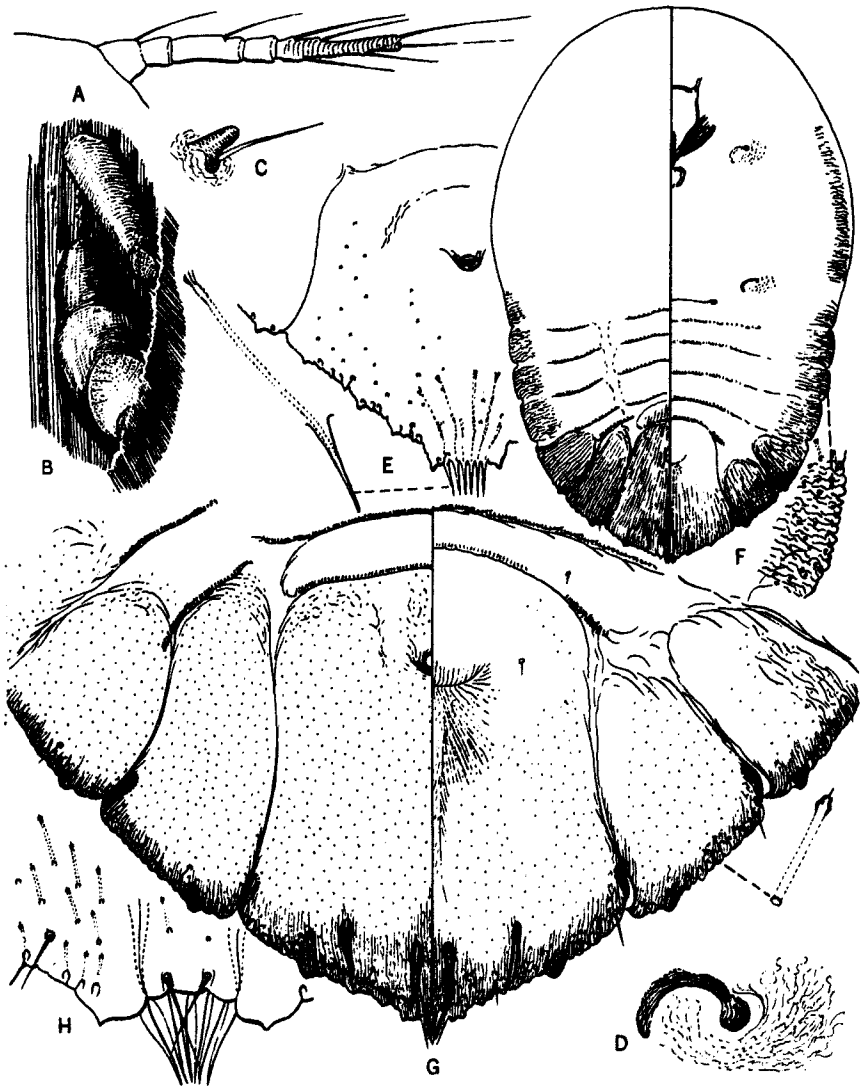

Fig. 129. *Odonaspis penicillata* Green, penicillate scale.

slight median ridge, exuviae at one end; male scale white, elongate, felted, and tricarinate.
Additional hosts: In addition to *Euonymus* spp. this scale has been taken on *Celastrus scandens, Daphne mezerem, Hibiscus, Jasminum, Lonicera, Pachysandra terminalis, Pachistima canbyi, Periclymenum, Prunus cerasifera, Prunus pissardi,* and *Syringa vulgaris.*
Discussion:
This species is readily recognized on *Euonymus* plants (see colored photograph). It is the only species of the genus represented in California. The scale is a serious pest to *Euonymus* and should be controlled whenever found.
California records:
Los Angeles Co.: Sierra Madre, II-23-49 (R. W. Harper and G. Beevor).
Marin Co.: San Anselmo, III-1-51 (E. Cowen).
Sacramento Co.: Sacramento, I-22-47 (E. T. Gammon and F. Daly).
San Mateo Co.: Atherton, V-29-53 (L. L. Barrett). North Palo Alto, X-23-47 (V. A. Canavese).
Santa Clara Co.: Palo Alto, V-1945 (G. F. Ferris).

Xerophilaspis prosopidis (Cockerell)
Mesquite scale
(Fig. 127)

Aspidiotus prosopidis Cockerell, 1895, Psyche, 7(1):15.
Xerophilaspis prosopidis (Cockerell), 1899. Check List, Supplement, p. 396.
Xerophilaspis prosopidis (Cockerell), Ferris, 1919, Stanford Univ. Publ., Univ. Ser., pp. 58-59, illus.
Xerophilaspis prosopidis (Cockerell), Ferris, 1937, Atlas of Scale Insects, Ser. I:136.
Type locality: Near Phoenix, Arizona.
Type host: *Prosopis* sp. (mesquite).
Relation to host: Occurring on the twigs of host. Adult female shiny black, although often covered with a whitish film, minute, almost circular, exuviae central or subcentral; male scale elongate, creamy white, exuvia near one end.
Additional hosts: Recorded only from *Prosopis* sp.
Discussion:
Ferris (1937) states: "The curiously shaped body of the adult female with the produced and sclerotized cephalic margin, the reduced pygidium with its two pairs of rounded lobes and its lack of perivulvar pores distinguish the species from any others in our fauna."
California records:
San Diego Co.: Mason Valley, X-3-46 (G. Beevor). San Diego, II-1920.

Tribe ODONASPIDINI

Odonaspis graminis Bremner
Grass root scale
(Fig. 128)

Odonaspis graminis Bremner, 1907, Canad. Ent., 39:368, illus.
Odonaspis graminis Bremner, Ferris, 1920, Stanford Univ. Publ., Univ. Ser. Biol. Sci., 1(1):57, illus.
Rugaspidis (=Rugaspidiotus) graminis (Bremner), MacGillivray, 1921, The Coccidae, p. 449.
Odonaspis graminis Bremner, Ferris, 1938, Atlas of Scale Insects, Ser. II:162.
Type locality: San Francisco, Presidio Hills, San Francisco County, California.
Type host: Undetermined grass.
Relation to host: Occurring under sheathing at leaf bases and among scales on the roots. Adult female scale brownish, broadly oval, exuviae at one end; male scale not observed.
Additional hosts: This scale has been collected and recorded mainly from undetermined grasses. Ferris (1938) records it on a grass, *Danthonia californica.*
Discussion:
The form of the body of this scale, together with the distribution of dorsal and ventral pygidial macroducts and the absence of perivulvar pores and marginal pygidial scleroses, distinguishes this species from other California *Odonaspis.* It is apparently quite rare in California.
California records:
Mendocino Co.: Mendocino City, IX-7-37 (G. F. Ferris).
San Francisco Co.: San Francisco, Presidio Hills, 1906 (E. M. Ehrhorn).
Santa Clara Co.: Stanford University, III-1918 (G. F. Ferris).
Sonoma Co.: Fort Ross, IX-1937 (G. F. Ferris).

Odonaspis penicillata Green
Penicillate scale
(Fig. 129)

Aspidiotus inusitatus Green, 1896. Coccidae of Ceylon, Part 1:66 (misidentification).

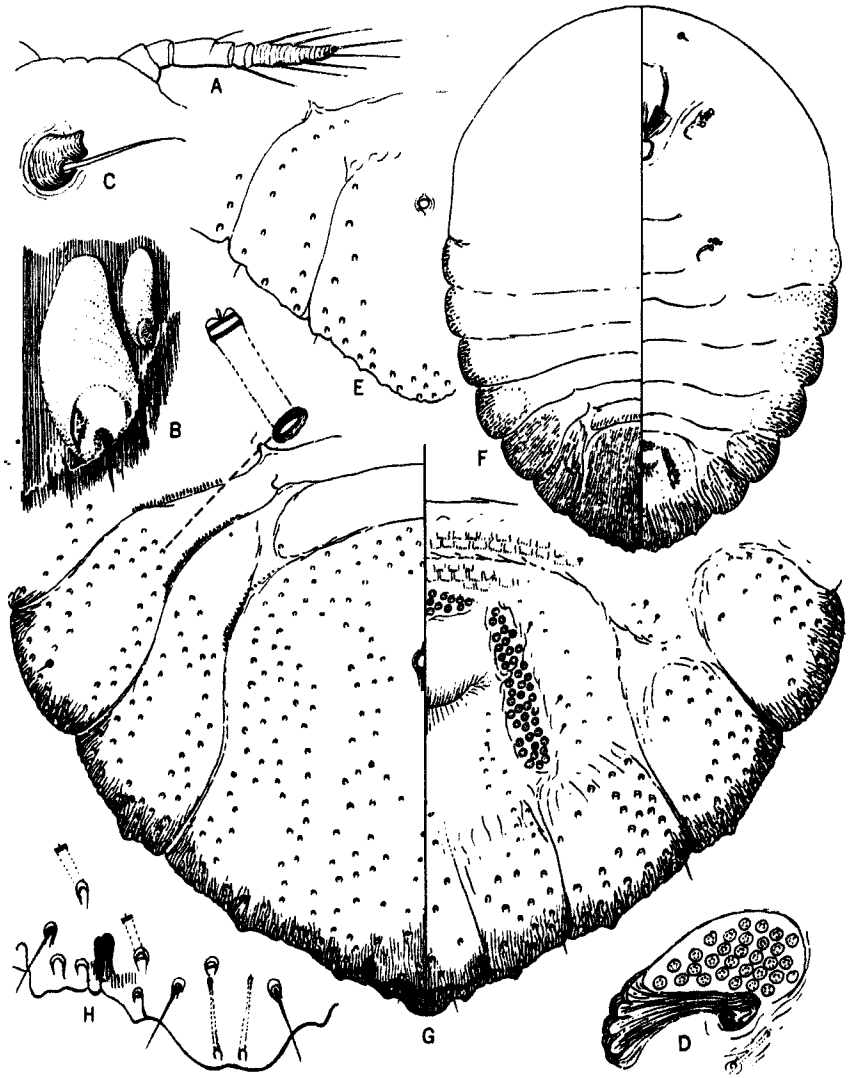

Fig. 130. *Odonaspis ruthae* Kotinsky, Bermuda grass scale.

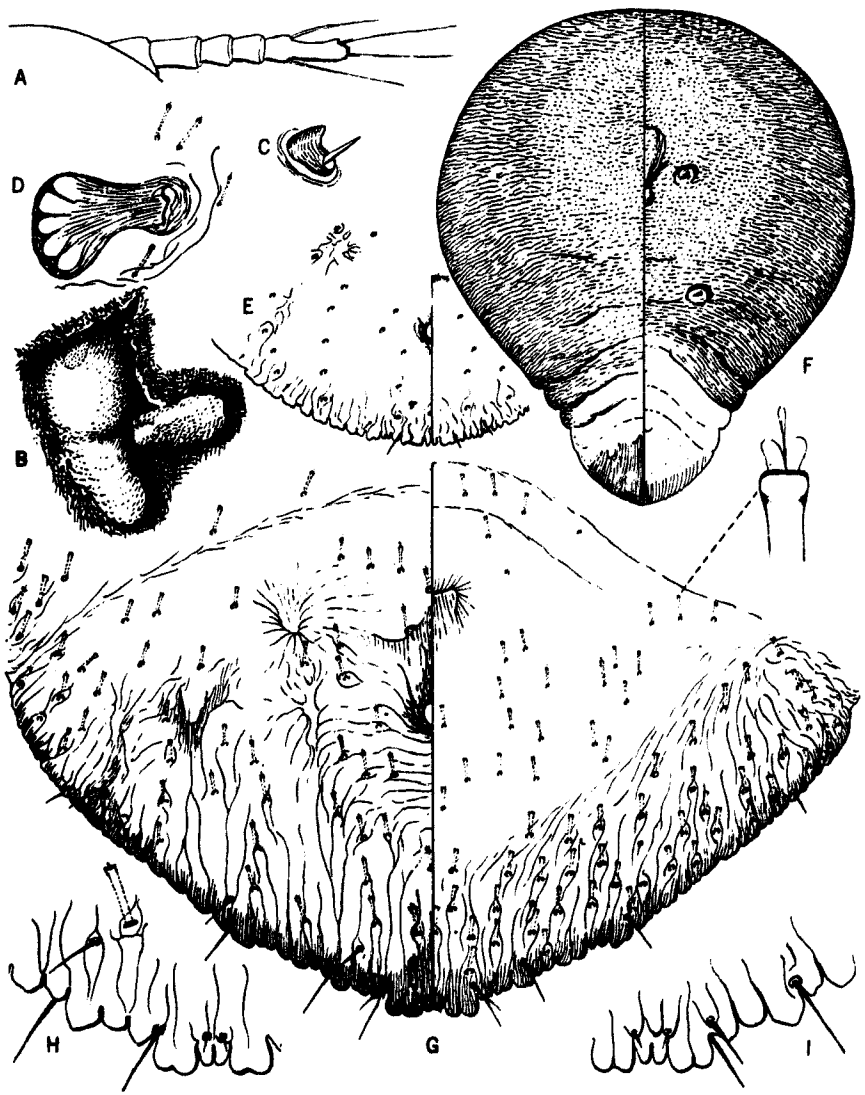

Fig. 131. *Rugaspidiotus arizonicus* (Cockerell), Arizona rugaspidiotus scale.

Odonaspis penicillata Green, 1905, Jour. Bombay Nat. Hist. Soc., 16:344, illus.
Odonaspis penicillata Green, Ferris, 1938, Atlas of Scale Insects, Ser. II:164.
Type locality: Ceylon.
Type host: *Gigantochloa aspera.*
Relation to host: Occurring under sheathing bases of the leaves, attached to the stem and not to leaf surface. Adult female scale brownish, elongate, broad anteriorly and tapering posteriorly, exuviae terminal; male scale brown, elongate and slender, exuvia at one end.
Additional hosts: *Bambusa stenostachya, Bambusa* spp., and *Ochlandra travancorica.*
Discussion:

This species is readily recognizable by the cluster of structures resembling gland spines that are situated apically on pygidium.
California records:

Los Angeles Co.: Altadena, II-25-41. Glendale, 1-29-44. Harbor City, IV-3-39. Los Angeles, XII-7-36 (V. E. Williams). Montebello, XII-2-38. North Hollywood, V-3-40. Palms, IV-12-38. San Gabriel, IX-24-40. Sautelle, VI-24-35 (V. E. Williams). West Los Angeles, VII-3-36 (V. E. Williams).

Orange Co.: Fullerton, III-26-41 (K. D. Sloop). Orange, III-26-41 (J. H. Mitchell). Santa Ana, II-24-32.

San Diego Co.: Coronado, I-15-44.

Santa Barbara Co.: Santa Barbara, IV-4-47 (I. B. Treloar).

Odonaspis ruthae Kotinsky
Bermuda grass scale
(Fig. 130)

Odonaspis ruthae Kotinsky, 1915, Proc. Ent. Soc. Wash., 17(3):101-104, illus.
Odonaspis graminis Bremner, Kotinsky, 1910, Proc. Hawaii. Ent. Soc., 2(3):129 (as a misidentification).
Odonaspis ruthae Kotinsky, Ferris, 1938. Atlas of Scale Insects, Ser. II:165.
Type locality: Honolulu, Hawaii.
Type host: *Cynodon dactylon,* Bermuda grass.
Relation to host: Occurring beneath the sheathing bases of the leaves and on the roots. Adult female scale white, broad, and elongate, tapering posteriorly, exuviae at broad end; male scale smaller, white, elongate, and slender, exuvia terminal.
Additional hosts: In addition to Bermuda grass, Ferris (1938) records various "succulents" and *Echeveria* sp. California State Department of Agriculture records include *Juncus, Sorghum halepense,* and *Sorghum vulgare sudanense.*
Discussion:

The scale is apparently California's most common *Odonaspis* species. It is easily differentiated from *Odonaspis graminis* Bremner and *O. penicillata* Green in the possession of perivulvar pores, lacking in the last-named species. *Odonaspis ruthae* Kotinsky is rather widespread in California, infesting in most instances bermuda grass.
California records:

Fresno Co.: Fresno, II-12-45 (J. W. Dixon).

Imperial Co.: Calexico, II-1-45 (A. J. Hanson and C. G. Anderson).

Kern Co.: Oildale, XII-7-39 (C. S. Morley).

Los Angeles Co.: Los Alamitos, V-31-34 (G. Garrettson). Los Angeles, I-1935 (V. E. Williams). Montebello, VII-22-36 (V. E. Williams). Pacoima, XI-23-38.

Orange Co.: Orange, VII-14-31 (E. Johnson).

Riverside Co.: Palm Springs, VIII-27-42 (C. R. Tower).

Sacramento Co.: Michigan Bar, XI-20-36 (T. E. Bachman).

San Diego Co.: Carlsbad, XI-26-41 (D. F. Palmer). San Diego, VIII-13-31 (R. R. McLean). Vista, XI-17-36 (J. G. Brunton).

Ventura Co.: Santa Paula, XII-4-39 (G. Dent). Ventura, IV-10-40 (R. Young).

Rugaspidiotus arizonicus (Cockerell)
Arizona rugaspidiotus scale
(Fig. 131)

Diaspis arizonicus Cockerell, 1900, Canad. Ent., 32:131.
Rugaspidiotus arizonicus (Cockerell), Ferris, 1938, Atlas of Scale Insects, Ser. II:168.
Type locality: Wooton (west of Phoenix), Arizona.
Type host: *Prosopis velutina,* velvet mesquite.
Relation to host: Occurring buried in deep cracks and under bark scales. Adult female scale white or brownish, anterior part somewhat swollen, tapering posteriorly, exuviae at swollen end; male scale similar to female in texture and color, elongate and slender, exuvia terminal.
Additional hosts: Recorded by Ferris (1938) on *Acacia flexicaulis, Lysiloma* sp., and an undetermined mimosaceous shrub.
Discussion:

This species is extremely rare in California. It differs from *Rugaspidiotus nebulosus* Ferris in possessing a sclerotized prosoma and a different

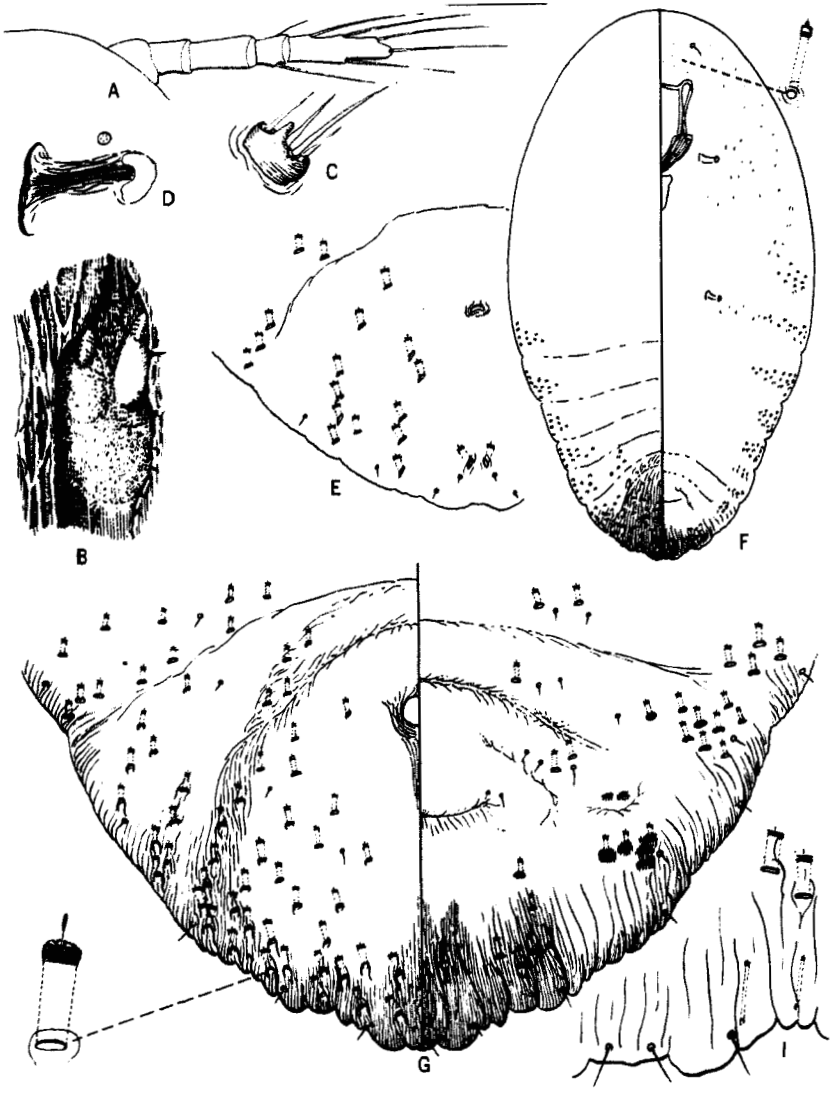

Fig. 132. *Rugaspidiotus nebulosus* Ferris, nebulose scale.

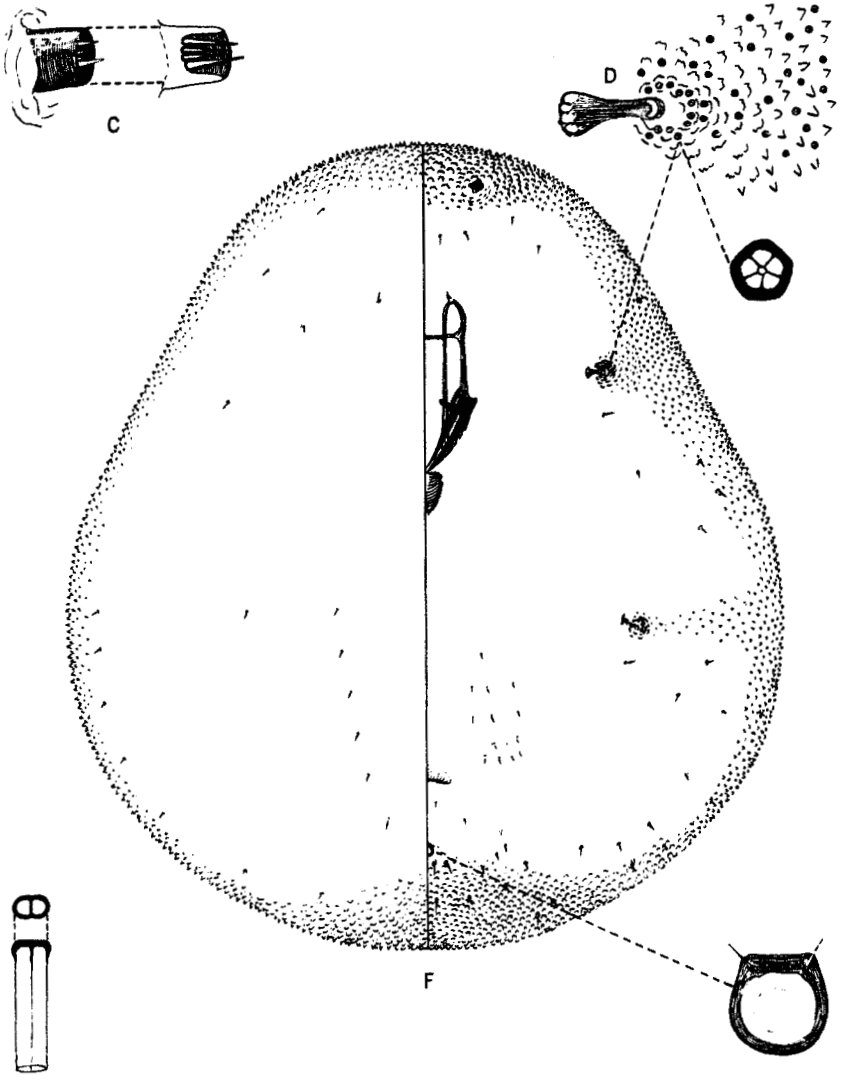

Fig. 133. *Phoenicococcus marlatti* Cockerell, red date palm scale.

position of anal opening and arrangement of dorsal and ventral pygidial ducts.

California records:

Imperial Co.: Andrade, III-30-45 (C. G. Anderson and A. J. Hanson).

Rugaspidiotus nebulosus Ferris
Nebulose scale
(Fig. 132)

Rugaspidiotus nebulosus Ferris, 1938, Atlas of Scale Insects, Ser. II:171.

Type locality: Azusa, Los Angeles County, California.

Type host: *Eriogonum fasciculatum.*

Relation to host: Occurring in cracks of the bark. Adult female white, elongate and, according to Ferris, "beset with threads of unconsolidated wax which gives it a fluffy appearance," exuviae at one end; male scale white, elongate, and slender, exuvia terminal.

Additional hosts: Recorded only from *Eriogonum fasciculatum.*

Discussion:

This scale is extremely inconspicuous being well hidden in bark cracks and crevices. It is apparently quite rare in California. It differs from *Rugaspidiotus nebulosus* Ferris in having a membranous prosoma and a differently situated anal opening, vulva, and pygidial ducts.

California records:

Los Angeles Co.: Azusa, IV-21-32 (L. E. Myers).

Subfamily PHOENICOCOCCINAE

Phoenicococcus marlatti Cockerell
Red date palm scale
(Fig. 133)

Phoenicococcus marlatti Cockerell, 1899, Proceed. Acad. Nat. Sci., Philad., p. 262.

Sphaerococcus draperi Newstead, 1906. Quart. Jour. Inst. Comm. Res. Trop., Liverpool Univ., 1(2):70.

Phoenicococcus marlatti (Cockerell), Stickney, 1934. U.S.D.A. Tech. Bull. 404:37-49, illus.

Phoenicococcus marlatti (Cockerell), Ferris, 1942, Atlas of Scale Insects, Ser. IV:444.

Phoenicococcus marlatti (Cockerell), Stickney, Barnes and Simmons, 1950. U.S.D.A., Cir. 846:8-15, illus.

Type locality: Algeria.

Type host: *Phoenix dactylifera,* date palm.

Relation to host: Occurring under the fibrous covering of the trunk or deeply imbedded at the bases of leaf petioles. Adult female scale reddish colored, more or less circular, slightly flattened, and surrounded by a ring of amorphous wax; adult male scale pale to dark pink, flattened, covered with a loose mass of white filaments.

Additional hosts: *Phoenicococcus marlatti* Cockerell occurs chiefly on plants of the palm genus *Phoenix.* In addition to *Phoenix dactylifera* the species has been reported by Stickney (1934) on *Phoenix canariensis* and *P. reclinata.* Stickney, Barnes, and Simmons (1950) indicate the species will grow on *Calamus, Daemonorops,* and *Pandanus.*

Discussion:

This is the so-called "red date scale" of economic entomologists. According to Ferris (1942) "there is nothing known in our fauna that can be confused with this species. It bears no evident similarity to any of the other species of Diaspididae, even to those which are placed in the same subfamily." It occurs in various localities in California where the date palm has been introduced, principally in the Imperial and Coachella valleys.

California records:

Stickney, Barnes, and Simmons (1950) record this scale as generally distributed in California in Coachella, Imperial, and Salt River valleys as well as from various points from Needles east, near Whittier and El Cajon. Specific records in the California State Department of Agriculture files include the following:

Imperial Co.: El Centro, II-2-44 (G. M. Hess and H. W. Gray).

Los Angeles Co.: Whittier, II-20-42 (C. Gammon).

Riverside Co.: Indio, I-16-30 (S. L. Lockwood). Palm Springs, I-28-43 (F. R. Platt).

Santa Barbara Co.: Montecito, IX-6-55 (T. Treloar and G. Beevor).

Solano Co.: Wolfskill Ranch (near Winters), XII-4-47 (H. T. Osborn and T. B. Gallion).

Ventura Co.: Ojai, III-22-47 (F. R. Lewis).

DISTRIBUTION TABLE

The table presents distributional information representing each diaspidid scale species by counties in California. Although several counties have no diaspidid scale species recorded from them, it is quite certain that representatives are present, and that if surveys were conducted diaspidids would be subsequently revealed.

Information used to prepare this table was taken almost exclusively from the accurate records both in the card files and in the insect collections of the California State Department of Agriculture, Bureau of Entomology. In a few instances, however, distribution and host records, as well as actual specimens, were made available by the Natural History Museum at Stanford University, California, and the Insect Identification Section, United States Department of Agriculture, Agricultural Research Section, Washington, D.C.

County	Acutaspis albopicta	Aonidia lauri	Aonidia shastae	Aonidiella aurantii	Aonidiella citrina	Aonidiella taxus	Aonidomytilus bilobis	Aonidomytilus ceanothi	Aonidomytilus concolor	Aonidomytilus variabilis	Aspidaspis arctostaphyli	Aspidaspis braunshvigi	Aspidaspis densiflorae	Aspidaspis florenciae	Aspidiotus destructor	Aspidiotus hederae	Aspidiotus spinosus	Aulacaspis rosae	Carulaspis minima	Carulaspis visci	Chionaspis americana	Chionaspis corni	Chionaspis etrusca	Chionaspis furfura	Chionaspis gleditsiae	Chionaspis ortholobis	Chionaspis salicis-nigrae	Chionaspis sassceri	Chionaspis wistariae	Chortinaspis consolidata	Chrysomphalus bifasciculatus	Chrysomphalus dictyospermi	Chrysomphalus ficus
Alameda				×	×											×		×		×									×		×		×
Alpine																																	
Amador																																	
Butte				×	×				×		×		×			×		×		×		×									×	×	
Calaveras																																	
Colusa																																	
Contra Costa																				×													
Del Norte																																	
El Dorado								×			×															×							
Fresno				×	×		×		×		×		×			×		×	×	×				×							×		×
Glenn				×	×								×					×															
Humboldt																				×													
Imperial				×				×	×														×										
Inyo							×		×																	×							
Kern				×	×			×								×		×		×			×			×					×		
Kings				×	×													×								–							
Lake			×					×																									
Lassen																											×						
Los Angeles		×		×	×	×				×			×		×	×	×	×	×	×	×	×	×		×	×			×		×	×	×
Madera				×				×			×									×		×				×							
Marin								×																							×	×	
Mariposa			×								×																						
Mendocino													×							×													
Merced				×	×															×													
Modoc																											×						
Mono																																	
Monterey																×			×	×													×
Napa				×																													
Nevada								×																									
Orange				×				×								×		×	×	×	×					×					×	×	×
Placer				×				×										×		×		×											
Plumas																																	
Riverside	×		×	×	×																		×			×		×			×	×	
Sacramento				×	×								×			×		×	×	×											×	×	×
San Benito													×																				
San Bernardino	×			×	×	×				×						×		×		×			×			×				×	×	×	×
San Diego			×	×	×				×	×	×			×		×	×	×	×	×			×	×		×		×	×		×	×	
San Francisco	×			×																×											×	×	×
San Joaquin				×												×		×													×	×	×
San Luis Obispo				×												×															×		
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County	Clavaspis covilleae	Clavaspis disclusa	Comstockiella sabalis	Diaspidiotus aesculi	Diaspidiotus ancylus	Diaspidiotus coniferarum	Diaspidiotus ehrhorni	Diaspidiotus liquidambaris	Diaspidiotus osborni	Diaspidiotus uvae	Diaspis boisduvalii	Diaspis bromeliae	Diaspis cocois	Diaspis echinocacti	Diaspis manzanitae	Diaspis parasiti	Duplachionaspis spartinae	Dynaspidiotus britannicus	Epidiaspis leperii	Epidiaspis salicicola	Fiorinia fioriniae	Fiorinia japonica	Fiorinia juniperi	Fiorinia theae	Furchadiaspis zamiae	Hemiberlesia cyanophylli	Hemiberlesia degenerata	Hemiberlesia fraxini	Hemiberlesia howardi	Hemiberlesia lataniae	Hemiberlesia palmae	Hemiberlesia popularum	Hemiberlesia quercicola
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Hemiberlesia rapax	Howardia biclavus	Kuwanaspis pseudoleucaspis	Lepidosaphes beckii	Lepidosaphes camelliae	Lepidosaphes chinensis	Lepidosaphes destefanii	Lepidosaphes ficus	Lepidosaphes gloverii	Lepidosaphes mackieana	Lepidosaphes machili	Lepidosaphes maskelli	Lepidosaphes noxia	Lepidosaphes sciadopitysi	Lepidosaphes tokionis	Lepidosaphes ulmi	Leucaspis cockerelli	Leucaspis portaeaureae	Lindingaspis rossi	Lineaspis cupressi	Melanaspis lilacina	Melanaspis obscura	Neopinnaspis harperi	Nilotaspis halli	Nuculaspis californica	Odonaspis graminis	Odonaspis penicillata	Odonaspis ruthae	Pallulaspis ephedrae	Parlatoreopsis chinensis	Parlatoria Blanchardii	Parlatoria camelliae	Parlatoria crotonis	Parlatoria oleae	Parlatoria pergandii	Parlatoria pittospori	Parlatoria proteus	Parlatoria theae	Phenacaspis fujicola	Phenacaspis pinifoliae	Phenacaspis sandwicensis	Phoenicococcus marlatti	Pinnaspis aspidistrae	Pinnaspis buxi	Pinnaspis strachani	Protodiaspis agrifoliae	Pseudaulacaspis pentagona	Pseudoparlatoria parlatorioides	Quadraspidiotus forbesi	Quadraspidiotus juglans-regiae	Quadraspidiotus perniciosus	Quernaspis quercus	Rhizaspidiotus dearnessi	Rugaspidiotus arizonicus	Rugaspidiotus nebulosus	Selenaspidus albus	Selenaspidus articulatus	Selenaspidus rubidus	Situlaspis atriplicis	Situlaspis daleae	Situlaspis multipora	Situlaspis yuccae	Stramenaspis kelloggi	Targionia bigeloviae	Unaspis euonymi	Xerophilaspis prosopidis	
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HOST LIST OF CALIFORNIA DIASPIDIDAE

The following host list of California Diaspididae is arranged alphabetically by plant families, and under each family the included genera are likewise set up. This is also true for the diaspidid species, these being recorded in alphabetical sequence under their respective host species.

In setting up the host list of California Diaspididae an attempt has been made to record every known host for each species with the exception of those forms which are obviously omnivorous. In these cases only a few of the more preferred hosts are indicated. Twenty-two species are here considered as omnivorous, and these are listed alphabetically under their respective tribes as follows:

Tribe Aspidiotini:

Aonidiella aurantii (Maskell), *Aonidiella citrina* (Coquillett), *Aspidiotus destructor* Signoret, *Aspidiotus hederae* (Vallot), *Aspidiotus spinosus* Comstock, *Chrysomphalus dictyospermi* (Morgan), *Chrysomphalus ficus* Asmead, *Diaspidiotus ancylus* (Putnam), *Hemiberlesia lataniae* (Signoret), *Hemberlesia rapax* (Comstock), *Quadraspidiotus forbesi* (Johnson), *Quadraspidiotus juglansregiae* (Comstock), and *Quadraspidiotus perniciosus* (Comstock).

Tribe Diaspidini:

Chionaspis furfura (Fitch), *Fiorinia fioriniae* (Targioni), *Howardia biclavis* (Comstock), *Lepidosaphes ulmi* (Linnaeus), *Parlatoreopsis chinensis* (Marlatt), *Parlatoria oleae* (Colveé), *Pinnaspis aspidistrae* (Signoret), *Pseudaulacaspis pentagona* (Targioni), and *Pseudoparlatoria parlatorioides* (Comstock).

PLANT FAMILY

ACANTHACEAE

Jacobinia sp., Jacobinia

Pseudoparlatoria parlatorioides (Comstock), 155

ACERACAE

Acer dasycarpum, Sugar maple

Diaspidiotus ancylus (Putnam), 61

Acer negundo

Diaspidiotus aesculi (Johnson), 59

Acer palmatum

Chrysomphalus dictyospermi (Morgan), 53

Neopinnaspis harperi McKenzie, 133

Acer rubrum

Diaspidiotus liquidambaris (Kotinsky), 62

Acer spp.

Diaspidiotus liquidambaris (Kotinsky), 62

Melanaspis obscura (Comstock), 77

Parlatoria camelliae Comstock, 139

Parlatoria crotonis Douglas, 139

AMARYLLIDACEAE

Agave sp.

Aonidiella aurantii (Maskell), 39

Aspidiotus hederae (Vallot), 47

Parlatoria proteus (Curtis), 145

Amaryllis sp.

Parlatoria proteus (Curtis), 145

ANACARDIACEAE

Mangifera indica, Common mango

Aspidiotus destructor Signoret, 47

Chrysomphalus ficus Ashmead, 55

Parlatoria proteus (Curtus), 145

Phenacaspis sandwicensis Fullaway, 149

Pinnaspis strachani (Cooley), 151

Selenaspidus articulatus (Morgan), 85

PLANT FAMILY

Mangifera spp.
Hemiberlesia cyanophylli (Signoret), 65
Parlatoria camelliae Comstock, 139
Pistacia atlantica, Pistache
Aspidaspis braunschvigi (Rungs), 45
Pistachia sp.
Parlatoreopsis chinensis (Marlatt), 137
Rhus trilobata, Sumac
Clavaspis covilleae (Ferris), 57
Rhus spp.
Chrysomphalus bifasciculatus Ferris, 51
Fiorinia fioriniae (Targioni), 111
Parlatoreopsis chinensis (Marlatt), 137
Schinus molle, Pepper tree
Neopinnaspis harperi McKenzie, 133
Schinus terebinthifolia
Neopinnaspis harperi McKenzie, 133

ANNONACEAE
Annona cherimola, Cherimoya
Chrysomphalus dictyospermi (Morgan), 53
Annona spp.
Hemiberlesia cyanophylli (Signoret), 65
Howardia biclavis (Comstock), 115
Asimina sp.
Parlatoreopsis chinensis (Marlatt), 137
Cananga odorata (= Canangium odoratum) Ylang-gyland
Phenacaspis sandwicensis Fullaway, 149

APOCYNACEAE
Allamanda cathartica variety *Schottia,* Schott common Allamanda
Howardia biclavis (Comstock), 115
Nerium indicum (= odorum), Sweetscented oleander
Pinnaspis buxi (Bouché), 150
Nerium oleander, Common oleander
Chrysomphalus bifasciculatus Ferris, 51
Chrysomphalus dictyospermi (Morgan), 53
Chrysomphalus ficus Ashmead, 55
Lindingaspis rossi (Maskell), 75
Neopinnaspis harperi McKenzie, 133
Phenacaspis sandwicensis Fullaway, 149
Pseudoparlatoria parlatorioides (Comstock), 155
Selenaspidus articulatus (Morgan), 85
Nerium sp.
Parlatoreopsis chinensis (Marlatt), 137
Quadraspidiotus perniciosus (Comstock), 81
Plumeria sp., Frangipani
Howardia biclavis (Comstock), 115
Tabernaemontana sp.
Acutaspis albopicta (Cockerell), 37

PLANT FAMILY

AQUIFOLIACEAE
Ilex aquifolium, Holly
Aonidiella citrina (Coquillett), 41
Aspidiotus hederae (Vallot), 47
Chrysomphalus bifasciculatus Ferris, 51
Dynaspidiotus britannicus (Newstead), 65
Lepidosaphes ulmi (Linnaeus), 127
Quadraspidiotus forbesi (Johnson), 79
Ilex cornuta
Chrysomphalus ficus Ashmead, 55
Hemiberlesia cyanophylli (Leonardi), 65
Hemiberlesia howardi (Cockerell), 69
Ilex integra
Hemiberlesia degenerata (Leonardi), 67
Ilex opaca
Hemiberlesia howardi (Cockerell), 69
Ilex sp.
Fiorinia fioriniae (Targioni), 111
Fiorinia theae Green, 113
Lepidosaphes beckii (Newman), 117
Parlatoria camelliae (Comstock), 139
Pseudoparlatoria parlatorioides (Comstock), 155

ARACEAE
Aglaonema sp.
Parlatoria proteus (Curtis), 145
Anthurium spp.
Fiorinia fioriniae (Targioni), 111
Hemiberlesia cyanophylli (Signoret), 65
Pinnaspis buxi (Bouché), 150
Dieffenbachia seguine, Seguin tuftroot
Parlatoria proteus (Curtis), 145
Monstera deliciosa, Ceriman
Parlatoria proteus (Curtis), 145
Philodendron sp., Philodendron
Acutaspis albopicta (Cockerell), 37
Hemiberlesia lataniae (Signoret), 69
Parlatoria proteus (Curtis), 145
Pothos aureus
Chrysomphalus ficus Ashmead, 55

ARALIACEAE
Aralia spp.
Aonidiella citrina (Coquillett), 41
Chrysomphalus bifasciculatus Ferris, 51
Hemiberlesia degenerata (Leonardi), 67
Fatsia spp.
Hemiberlesia lataniae (Signoret), 69
Hedera helix, Ivy
Aonidiella citrina (Coquillett), 41
Aspidiotus hederae (Vallot), 47
Chrysomphalus bifasciculatus Ferris, 51
Chrysomphalus dictyospermi (Morgan), 53
Chrysomphalus ficus Ashmead, 55

PLANT FAMILY

Viburnum tinus, Laurestinus Viburnum
Parlatoria pittospori Maskell, 143
Viburnum sp.
Aonidiella citrina (Coquillett), 41
Aspidiotus spinosus Comstock, 49
Chrysomphalus ficus Ashmead, 55
Dynaspidiotus britannicus (Newstead), 65
Hemiberlesia howardi (Cockerell), 69
Parlatoreopsis chinensis (Marlatt), 137
Parlatoria theae Cockerell, 147
CARYOPHYLLACEAE
Dianthus caryophyllus, Carnation
Pseudoparlatoria parlatorioides (Comstock), 155
CASUARINACEAE
Casuarina sp., Beefwood
Howardia biclavis (Comstock), 115
CELASTRACEAE
Catha edulis, Arabian tea
Chrysomphalus bifasciculatus Ferris, 51
Celastrus scandens, American Bittersweet
Unaspis euonymi (Comstock), 159
Euonymus japonicus
Neopinnaspis harperi McKenzie, 133
Euonymus latifolius
Unaspis euonymi (Comstock), 159
Euonymus spp.
Aonidiella aurantii (Maskell), 39
Aonidiella citrina (Coquillett), 41
Aspidiotus spinosus (Comstock), 49
Chrysomphalus bifasciculatus Ferris, 51
Chrysomphalus dictyospermi (Morgan), 53
Chrysomphalus ficus Ashmead, 55
Clavaspis covilleae (Ferris), 57
Hemiberlesia lataniae (Signoret), 69
Lepidosaphes gloverii (Packard), 121
Lindingaspis rossi (Maskell), 75
Parlatoreopsis chinensis (Marlatt), 137
Parlatoria camelliae Comstock, 139
Parlatoria pergandii Comstock, 143
Parlatoria theae (Cockerell), 147
Unaspis euonymi (Comstock), 159
Pachistima canbyi, Canby Pachistima
Unaspis euonymi (Comstock), 159
CHENOPODIACEAE
Allenrolfea occidentalis, Pickleweed
Aonidomytilus bilobis Ferris, 87
Atriplex sp.
Aonidomytilus bilobis Ferris, 87
Aonidomytilus concolor (Cockerell), 89
Situlaspis atriplicis (Ferris), 155
Chenopodiaceous plant
Aonidomytilus concolor (Cockerell), 89
Spiraea vetchi, Seedling
Nilotaspis halli (Green), 135

PLANT FAMILY

Spiraea sp.
Parlatoreopsis chinensis (Marlatt), 137
Situlaspis yuccae (Cockerell), 157
Suaeda spp., Seepweed
Aonidomytilus concolor (Cockerell), 89
COMPOSITAE
Ambrosia spp., Ragweed
Rhizaspidiotus dearnessi (Cockerell), 83
Aplopappus heterophyllus, (= Isocoma wrightii), Jimmyweed
Rhizaspidiotus dearnessi (Cockerell), 83
Aplopappus laricifolius
Aonidomytilus concolor (Cockerell), 89
Rhizaspidiotus dearnessi (Cockerell), 83
Aplopappus linearifolius
Rhizaspidiotus dearnessi (Cockerell), 83
Artemisia filifolia, Sage brush
Rhizaspidiotus dearnessi (Cockerell), 83
Artemisia spp.
Lindingaspis rossi (Maskell), 75
Aster spp.
Rhizaspidiotus dearnessi (Cockerell), 83
Baccharis pilularis
Rhizaspidiotus dearnessi (Cockerell), 83
Baccharis viminea
Hemiberlesia popularum (Marlatt), 73
Bigelovia brachylepis
Targionia bigeloviae (Cockerell), 87
Composite
Rhizaspidiotus dearnessi (Cockerell), 83
Corethrogyne sp., Cottonaster
Rhizaspidiotus dearnessi (Cockerell), 83
Encelia farinosa
Aonidomytilus concolor (Cockerell), 89
Franseria dumosa, Bursage
Rhizaspidiotus dearnessi (Cockerell), 83
Franseria spp.
Aonidomytilus concolor (Cockerell), 89
Grindelia cunefolia, Gumweed
Rhizaspidiotus dearnessi (Cockerell), 83
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The following host index uses the botanical nomenclature in *Standardized Plant Names*, 1942, 2d ed., by Harlan P. Kelsey and William A. Dayton. Both the common and the scientific names are listed as aids in finding desired information. The page numbers refer to the host list included on pages 173 to 192.

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In the following index the names listed in italics are synonyms, whereas those in roman letters represent distinct species. Subfamily, tribe, and generic names are likewise included in roman letters.

Both the common as well as the scientific name are listed to help find the desired information.

BULLETIN OF THE CALIFORNIA INSECT SURVEY

VOLUME 5

THE ARMORED SCALE INSECTS OF CALIFORNIA

ERRATA AND SUPPLEMENTAL NOTES

BY

HOWARD L. McKENZIE

(State of California Department of Agriculture, Bureau of Entomology)

1957

THE ARMORED SCALE INSECTS OF CALIFORNIA *

ERRATA AND SUPPLEMENTARY NOTES

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The following changes should be made in this volume at the points indicated.

Page 21. Category which keys out the Subfamily Diaspidinae should read as follows: "Adult female with anal opening dorsal," etc.

Page 22. Couplet 7 (6), second half which keys out Hemiberlesia (p. 65), omit last part which reads as follows: "one species without lobes and with plates very small, but with very large anal opening." - - -

Page 28. Alter couplet 13 (11) to couplet 16 (14) as indicated on next sheet. Cut out and glue in volume.

Page 29. Couplet 26 (25), alter first half as follows: "not present posterior to fifth segment, except, in one species, for a single submarginal duct anterior to second pygidial lobe; known in North America," etc.

Page 29. Alter couplet 23 (22) and include couplet 23A (23) as indicated at bottom of next sheet. Cut out and glue in volume. These couplets should precede couplet 24 (17).

Page 43. Right column, third paragraph, change to (see Fig. 9).

Pages 52 and 54. Figures 18 and 20 representing Chrysomphalus bifasciculatus Ferris and Chrysomphalus ficus Ashmead respectively are reversed.

Page 57. Common name of Clavaspis disclusa Ferris is Discluse scale.

Pages 112 and 113. Fiorinia juniperi Leonardi, not Bouché. The original reference to Leonardi's description is Redia, 3:39, 1906.

Page 121. Right column, first paragraph, last sentence, change figure numbers as follows: "A detailed drawing of ficus (Fig. 86) and its dimorphic form (Fig. 87), is here presented."

Page 149. Professor G. F. Ferris (Microentomology, 20 (3):46-47, 1955, illus.) has placed Phenacaspis sandwicensis Fullaway as a synonym of Phenacaspis cockerelli (Cooley).

Page 176. Column one, bottom, Spiraea should go into Rosaceae (p. 189) instead of Chenopodiaceae.

Page 182. Lepodosaphes ficus (Signoret) should also be placed under Ficus carica.

Page 186. Left column, correct two misspellings of Cupressus.

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* Published in 1956 as Volume 5, Bulletin of the California Insect Survey, by the University of California Press.

Cut out couplets below and glue in volume on pages indicated

Page 28

13 (11). *Pygidium tapering abruptly, acute, mesal margins of median pygidial lobes contiguous but not fused.* . . . . . *Neopinnaspis* (p. 133)

Pygidium broad; median pygidial lobes various but without mesal margins contiguous. 14

14 (13). *With elongate, club-shaped, internal, sclerotized process arising from base of each median pygidial lobe; dorsum of prosoma strongly sclerotized as far posteriorly as first abdominal segment.* . . . . . *Howardia* (p. 115)

Without elongate, club-shaped, internal sclerotized process arising from base of each median pygidial lobe; prosoma membranous. 15

15(14). *Median pygidial lobes well separated, with an appearance of a two-forked gland spine between these lobes.* . . . . . *Pseudoparlatoria* (p. 155)

Median pygidial lobes various, without a forked gland spine between but sometimes with a pair of distinctly separated gland spines in the interspace. 16

16(15). *Margin of pygidium with membranous, etc.*

Page 29

23 (22). *Third pygidial lobe present, flattened, resembling first lobule of second lobe in size and form.* . . . *Pallulaspis* (p. 135)

Third pygidial lobe, if recognizable at all, merely a sclerotized point. 23A

23A (23). *Dorsal pygidial macroducts, although few, arranged in definite segmental rows.* . . . . . *Nilotaspis* (p. 135)

Dorsal pygidial macroducts scattered or in broad bands, not in segmental rows. . . . . . *One species of Aonidomytilus* (p. 87)