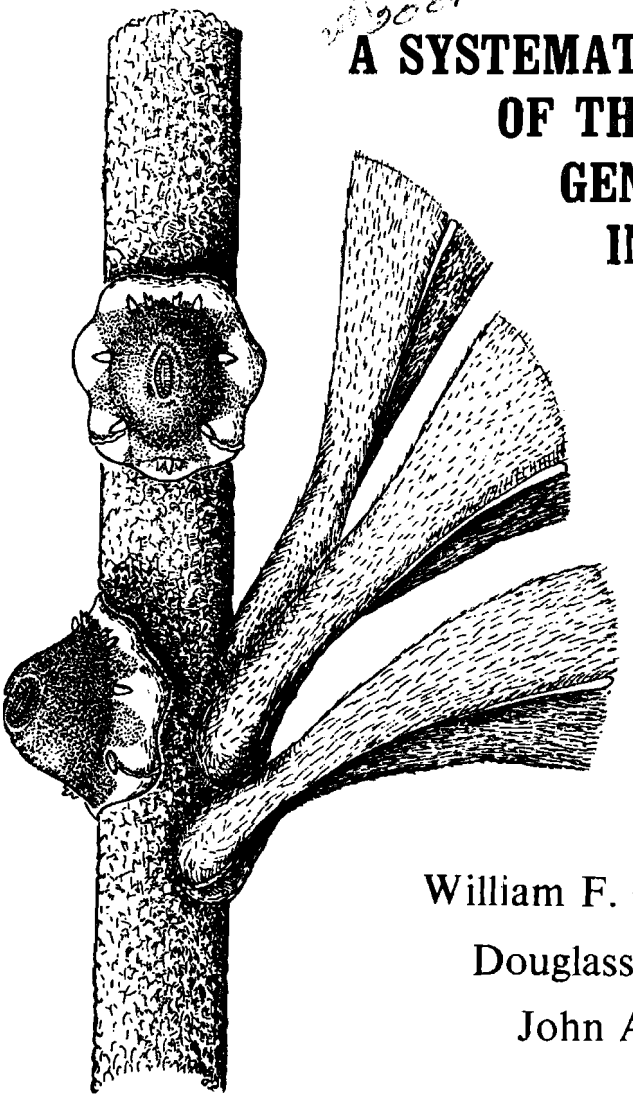

A SYSTEMATIC REVISION OF THE WAX SCALES, GENUS CEROPLASTES, IN THE UNITED STATES (HOMOPTERA; COCCOIDEA; COCCIDAE)

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INTRODUCTION

The genus *Ceroplastes* Gray is a homogeneous group of soft scale species characterized by a thick wax test which covers the body of the adult female. These so-called "wax scales" are most abundant in tropical and subtropical areas, but are known from all zoogeographic regions. According to De Lotto (1965), there are approximately 150 known species, subspecies, and varieties of *Ceroplastes*. In North America and the Caribbean Islands there are about 30 species (Morrison unpublished) with approximately an equal number in Central and South America.

Unfortunately, little is known about the systematics of North American *Ceroplastes*. Important papers have been published by Bedford (1968), Ben-Dov (1970), Borchsenius (1957), Cilliers (1967), De Lotto (1965, 1969a, 1969b, 1971), Ezzat and Hussein (1967), Green (1909), Hodgson (1969), Kawai and Tamaki (1967), Kuwana (1923), Sankaran (1959a, 1959b, 1962), and Signoret (1872), but they deal primarily with Old World or pest species. At present there are no comprehensive systematic papers treating the species of the New World.

The earliest known collection of a wax scale in the U.S. was of *floridensis* Comstock January 17, 1828, in Jacksonville, Florida. In 1880 Comstock spent the winter and spring in Florida and collected 2 species of *Ceroplastes* which he later described as *floridensis* and *cirripediformis* Comstock. From 1881 to 1971 4 additional species were recorded in the U.S.; the present study reports 5 more, making a total of 11. It is of interest that none of the 11 species are known from the U.S. alone. Several species have limited distributions, but are either known from Florida and the Caribbean Islands or from the southwestern U.S. and Mexico.

The stimulus that initiated this study was the increasing concern of homeowners and nurserymen regarding heavy infestations of *ceriferus* (Fabricius) in ornamental plantings in Virginia and Maryland. Collections of this species indicate that it spread rapidly along the east coast. Based on our records, it was first collected in the U.S. in 1936 on *Camellia japonica* in Savannah, Georgia. During the early 1950's it moved northward into Virginia and during 1959 was collected in Maryland. Little was known about the life cycle or control of the scale, and there was a great deal of confusion concerning its identity. It was evident that the time had come for concentrated research on the wax scales of the U.S.

In May, 1969, a cooperative wax scale research program was formulated by T. J. Henneberry and F. F. Smith, formerly of Vegetables, Ornamentals, and Specialty Crops, Insect Research Branch, USDA; C. W. McComb, Maryland State Department of Agriculture; J. A. Weidhaas, Jr., Extension Division, Virginia Polytechnic Institute and State University; and one of the authors (Davidson). The Vegetables, Ornamentals, and Specialty Crops, Insect Research Branch agreed to provide greenhouse space and technical assistance to the University of Maryland entomologists for work on the taxonomic and biological aspects of the program. Virginia Polytechnic Institute and State University entomologists agreed to study methods of control. In addition, the Holly Society of America agreed to provide financial aid to the Maryland entomologists.

This paper provides descriptions, keys, and illustrations of the 11 species of wax scales known to occur in the U.S. With this information as a basis, it is hoped entomologists will be able to identify species of wax scales collected within the area covered.

MATERIALS AND METHODS

Approximately 1,800 slides, bearing about 2,500 specimens, were examined during the course of this study. The material is deposited in the following collections: British Museum (Natural History), London (BM); California State Department of Agriculture, Sacramento (CDA); Australian National Insect Collection, Commonwealth Scientific and Industrial Research Organization, Canberra, Australia (CSIRO); Florida State Collection of Arthropods, Gainesville (FSCA); Mexican National Collection, Mexico City (MNC); Museum National d'Histoire Naturelle, Paris (MNHN); personal collection of Michael L. Williams (MW); Plant Protection Research Institute, Pretoria, Republic of South Africa (PPRI); Tokyo Agricultural Experiment Station (TAES); University of California at Davis (UCD); University of Hawaii, Honolulu (UH); University of Maryland, College Park (UM); United States National Museum of Natural History, Washington, D.C. (USNM); Virginia Polytechnic Institute and State University, Blacksburg (VPI); personal collection of William F. Gimpel, Jr. (WG); Zoological Institute, Academy of Sciences of USSR, Leningrad (ZAS). The place of deposition of each slide is indicated in the species treatments. Additional abbreviations used in this paper, excluding those used in the adult male descriptions, are as follows: Animal and Plant Health Inspection Service (APHIS); Agricultural Research Service (ARS); Maryland State Department of Agriculture (MSDA); United States Department of Agriculture (USDA).

Most of the type material available for this study was composed of mounted and unmounted syntypes. If dry type material was available, a series of specimens was mounted. When necessary, a lectotype was designated from either the newly or previously mounted syntypes.

Measurements were made using a Wild eyepiece micrometer at magnifications of 100, 400, and 1,000. When possible, at least 10 specimens were used to obtain the measurements and counts which are given as follows: average (lower extreme - upper extreme). Measurements are accompanied by a symbol for microns or millimeters whereas counts are without symbols, e.g., 3.0 μ (1.0 - 7.0) is a measurement and 3.0 (1.0 - 7.0) is a count.

An illustration is provided for each species as the insect appears when mounted on a slide. Each illustration is divided longitudinally, with the left half representing the dorsum and the right half the venter. Structural details are shown as enlargements near the margin of the illustration, and are not drawn to scale. In some highly variable species 2 illustrations are included. Because of the large amount of variation in the stigmatic and dorsal setae and because of their importance as characters used to separate species, we have included 4 plates showing only these structures. On these plates the setae are all drawn to the same scale. An illustration of the external wax of each species has also been provided when possible.

BIOLOGY

This is intended only as a very general biology section; a more detailed paper on *Ceroplastes* life history is planned for the future.

In the U. S. all species of *Ceroplastes* appear to have similar life histories with 4 instars in the female and 5 in the male; the latter sex, when known, is normally rare. Males and females can first be differentiated in the second instar (i.e., *ceriferus* and *cirripediformis*). The wax test of the male, particularly the dorsomedial dry wax, is more elongate and rests on the substrate at a slightly different angle (fig. 9) than the test of the female. The male molts to a prepupa and pupa inside the test before emerging as an adult.

In most areas of the U. S. species of *Ceroplasts* have only 1 generation/year, although cultures of *ceriferus*, *cirripediformis*, and *sinensis* Del Guercio maintained in the greenhouse at the University of Maryland have 1 and ½–2 generations/year. This seems to indicate that in the warmer areas some species may have more than 1 generation/year.

In the spring each overwintering female lays from several hundred to several thousand eggs beneath her body. As egg laying proceeds, the ventral surface of the female becomes more and more concave and forms a brood chamber. The crawlers hatch in late spring or early summer, and 2 or 3 days later leave the brood chamber and begin to settle. In some species the crawlers settle mainly on the stem of the host and remain at that site for the duration of their life cycle, whereas others usually settle on the leaves as crawlers and migrate to the stems as third instars.

Although males are apparently present in small numbers, parthenogenesis seems to be the primary method of reproduction. We tested this belief by isolating a second instar female of *ceriferus* and allowed her to complete her life cycle in the absence of a male. She laid eggs which hatched into crawlers that settled

and matured normally; they were predominantly females.

ECONOMIC IMPORTANCE

Several *Ceroplastes* species are considered to be serious economic pests for a number of reasons. Most secrete large quantities of honeydew which often covers the leaves and stems of the host, and acts as a medium for black sootymolds that give the host plant an unslightly appearance. The large size and light color of most species cause their presence to be readily noticeable and therefore detracts from the appearance of the host. Plants with heavy infestations often show evidence of a general decline in vigor and develop an unsightly "leggy" appearance with the leaves of most branches confined to rosettes of new growth at the tips. Severe infestations may cause dieback of the host. In nurseries, infestations of wax scale are a particular problem since many states require nursery stock to be free of disease and insect pests before sale, and costly spray programs may be necessary to destroy infestations. Several species of *Ceroplastes* infest citrus and often are found as contaminants on the fruit. On citrus, in addition to the usual honeydew and decreased vigor problems, it is neccessary to remove the sootymolds and wax scales from the fruit prior to marketing. The home-owner interested in a healthy, well-groomed landscape, also must control the wax scales.

For more detailed information see the "Economic Importance" sections in the species descriptions.

TERMINOLOGY

Several terms used in this paper are either employed for the first time or need clarification. They are as follows:

WET WAX AND DRY WAX – These terms were first used by Kawai and Tamaki (1967), and we feel that they are both descriptive and useful. The "wet wax", which is produced only by the 3rd and 4th instar females, has a paste-like texture and when squeezed between the fingers produces a drop of liquid (called "interior honeydew" by Kawai and Tamaki 1967) suggesting the term "wet". "Dry wax", on the other hand, has a mealy texture and does not contain an aqueous substance (Kawai and Tamaki 1967) suggesting the term "dry".

CLEAR AREAS – This term was first used by Williams and Kosztarab (1972) for the areas on the dorsum which lack the large dorsal pores. These areas are normally located as follows: 1 cephalic, 1 mediodorsal, 6 lateral, and 1 surrounding the anal process. These areas actually are dotted with the orifices of the primary wax pores (plate 1c), but these pores are so small that they are very difficult to see with a light microscope. The following terms have been used for "clear areas" by other workers: swellings or prominences (Bedford 1968); membranous processes (DeLotto 1969, Ben-Dov 1970); tubercles (Cillers 1967); cephalic and lateral processes (Hodgson 1969); conical tubercles (Kuwana 1923); supra-marginal prominences (Sankaran 1959b).

ANAL PLATE SETAE -- Because of the difficulty in differentiating the discal, subdiscal, and apical setae on species of *Ceroplastes*, we have combined these terms and referred to them as dorsal setae of the anal plates. For simplicity, we have used ventral setae of the anal plates for those setae normally referred to as subapical setae.

STIGMATIC SETAE – This term is generally used by coccid taxonomists for the setae present in the lateral margin of the stigmatic furrows. These setae are normally differentiated in size and/or shape from the marginal setae. On adult females of *Ceroplastes* species this type of seta is unusually abundant and is sometimes distributed well beyond the limits of the stigmatic furrows. The question has arisen whether the differentiated setae which occur outside of the stigmatic areas should be called stigmatic setae. We feel that since the differentiated setae both inside and outside of the stigmatic furrows are all basically the same size and shape, and since in the past they have all been called stigmatic setae (see DeLotto 1969b) we will continue to use this terminology.

STIGMATIC PORES – This term is used for the pores that occur in the stigmatic furrow and have from 4-10 loculi (normally 5). In the past the term quinquelocular has been used for this type of pore, but in the U. S. species of *Ceroplastes* there are normally a few pores in the stigmatic furrows near the stigmatic setae which have more than 5 loculi.

MULTILOCULAR PORES – This term is used for the ventral pores which have 6-14 loculi (normally 10) and are most abundant near the vulva.

MORPHOLOGY

WAX TEST -- Adult females of U.S. *Ceroplastes* species have a thick wax test covering the dorsal area of the body. In order to understand the structure of its component parts, it is necessary to describe briefly the structure of the wax produced during each instar. The first instar possesses a dorsal cap of dry wax which covers most of the dorsum and a series of about 15 submarginal filaments of dry wax located as follows: 1 mediocephalic, 2 laterocephalic, 8 lateral, and 4 caudal. The anal plates are flanked by the 4 caudal processes, 2 on each side. Depending upon the species, the wax filaments vary from apically pointed to forked and are normally white. In the second and third instars the wax filaments of the earlier instars are retained and enlarged. The third instars also secrete a wet wax which covers the remainder of the dorsum. This wax flows around the dry wax filaments leaving only their apices exposed. In the area of the stigmatic furrows a narrow band of filamentous dry white wax becomes evident as the wet wax curls onto the dorsal submargin. The wet wax may be produced into a forward tilting dunce cap-like horn or may remain dome-like, and may vary from white to yellow to reddish brown. In the fourth instar the marginal wax of the first, second, and third instars is retained and enlarged. The dorsal dry wax process of the earlier instars may be retained as a small apical cap or be pushed up by the wet wax, forming a small raft. The apices of the marginal dry wax filaments remain exposed, and depending upon the species, vary from pointed to forked. In the area of the stigmatic furrows the bands of filamentous dry white wax become more evident. Also depending upon the species, the wet wax may or may not be divided into plates and the color may vary from white to brown. The structure and color of the wax test are characteristic of the species.

VENTRAL WAX SECRETIONS -- These secretions of the adult female are of the following types: filamentous dry white wax apparently secreted from the stigmatic pores in the stigmatic furrows; filamentous wax apparently secreted from the tubular ducts in the cephalic and vulvar regions; granular dry white wax apparently secreted from the multilocular pores predominantly located in the vulvar area; sticky translucent wax apparently secreted from the cruciform pores which are located predominatly along the submargin.

The **Stigmatic Pore Secretion** of the stigmatic furrows (plate 1a) appears as a narrow band of filamentous wax which fills each furrow; on the margin the band becomes as broad as the stigmatic setal cluster, curls onto the dorsal submargin, and always appears to be associated with the stigmatic setae. We believe that the stigmatic setae, or possibly associated glands, secrete the dry filamentous wax observed laterad of the stigmatic furrows. We base this conclusion on the following evidence. Normally the stigmatic setae are confined to an area laterad of the stigmatic furrows as is the band of filamentous wax.However, *irregularis* lacks the posterior cluster of stigmatic setae and also lacks the corresponding filamentous wax. In contrast, *dugesii* Lichtenstein has stigmatic setae and the associated filamentous wax present around the entire margin, although the setae and wax are concentrated laterad of the stigmatic furrows.

The **Tubular Duct Secretion** of the cephalic and vulvar regions appears just prior to and during oviposition. This secretion is very thin and becomes twisted much like small tufts of lint. This wax probably aids in separating eggs in the brood chamber.

The **Multilocular Pore Secretion** located in the vulvar region appears a week or so prior to oviposition and is a granular or powdery white wax. As eggs emerge from the vulva they appear to be wet and stick end to end forming a long "chain". The powdery wax of the multiloculars coats the surface of the chorion. This apparently acts as a dry covering which prevents the eggs from sticking to each other and to the walls of the brood chamber, and allows the eggs to be pushed anteriorly as successive eggs are laid.

The **Cruciform Pore Secretion**, predominantly located on the submargin, is present throughout the life of the insect. This sticky translucent wax apparently forms a fragile ventral cover and cements the submargin to the host.

BODY STRUCTURE -- The bodies of *Ceroplastes* species range from dark red to yellowish brown. In most species the adult female is oval in outline, when viewed dorsally. In lateral view, young adult females appear dorsoventrally compressed but become convex with age. In young adults the derm is membranous but becomes sclerotized with age.

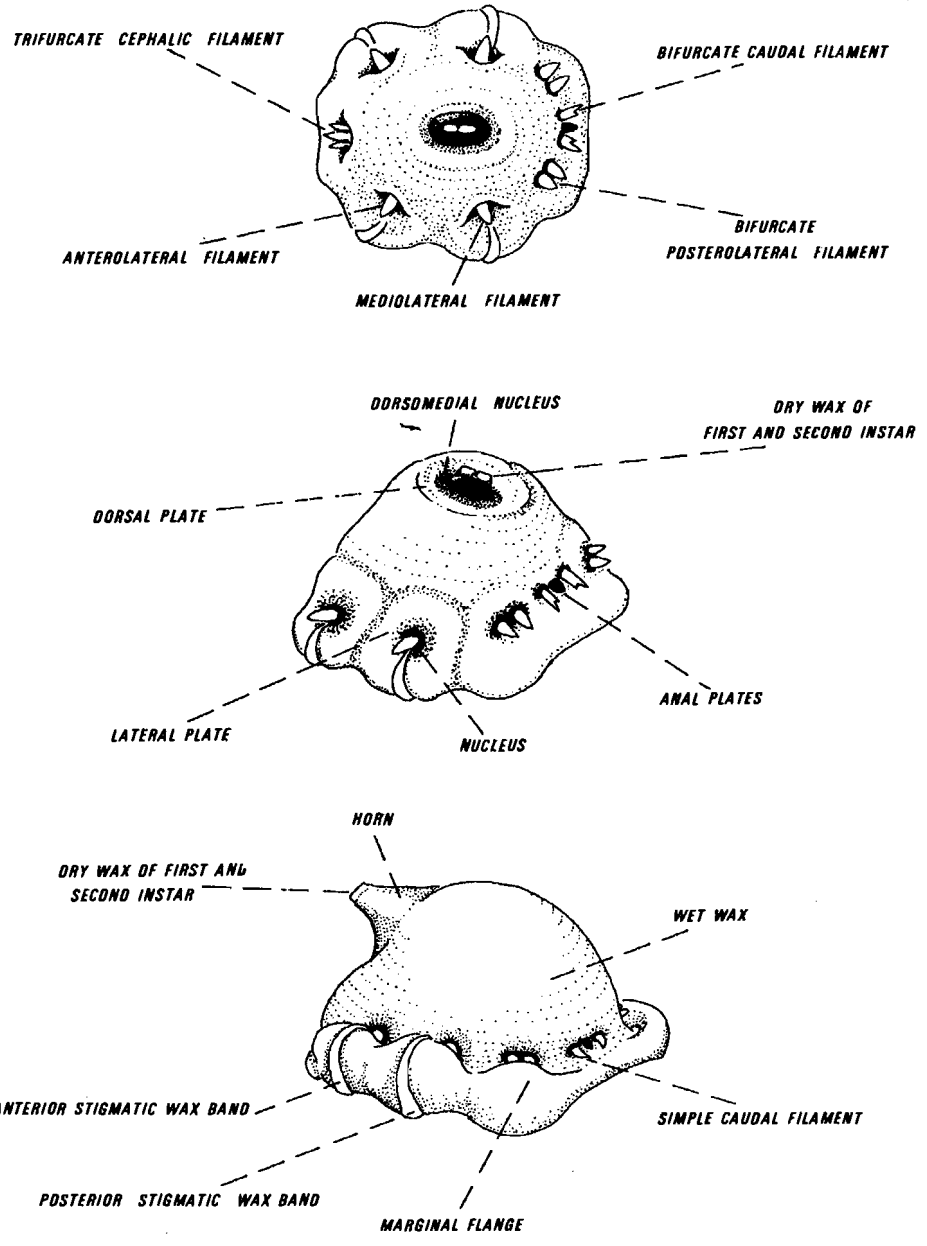


Figure 1. General morphology of wax test of adult female.

The **Segmentation** of the body is not discernible on the dorsum and is only partially evident on the venter. We accept the assumption of Ferris (1950) that the vulva is located medioventrally on the 8th abdominal segment. Head and thoracic segmentation is marked medioventrally by very faint segmental lines. The anal plates are part of segment 9 and the anal ring is apparently part of segment 10 or 11. The remainder of the abdominal segments are numbered anteriorly from the vulva. The second segment is the first anterior abdominal segment.[1]

The **Anal Lobes** are marginal projections located on either side of the anal cleft. They possess a cluster of bristle-shaped marginal setae which are normally thicker and longer than the setae located elsewhere on the margin. The lobes may be observed in most preparations, but are quite evident on specimens mounted in Hoyer's medium.

The **Anal Process** is the heavily sclerotized area surrounding the anal plates, which increases in area and length with age. In general there are 2 types: 1 is pad-like and increases in area but not in length; the other is horn-like and increases both in area and in length. Normally, the anal process is confined to the dorsal portion of the posterior abdominal segments. It is interesting that in species with a thick wax covering the anal process increases in length at about the same rate as the dorsal wet wax increases in thickness. This effectively maintains a passage for waste elimination.

The **Anal Plates** are heavily sclerotized paired structures located at the apex of the anal process. They are smooth and usually not more than twice as long as their greatest width. Each plate is roughly triangular, with a blunt anterior end, a narrow posterior end, a rounded lateral margin, and a straight inner margin. The straight inner margin allows the plates to come together to form an operculum which protects the anal ring and anus. Each plate has 3 or 4 dorsal setae and 1-3 ventral setae. (See p. 4 for discussion of terms.) The number of ventral setae is a valuable taxonomic character.

The **Anal Ring** is a sclerotized band surrounding the anus which bears 8 setae and numerous wax pores. It is located at the distal end of the membranous anal tube which is constructed so that it can be everted, positioning the anal ring beyond the apex of the body. Normally, the ring is withdrawn, concealing its setae, and the orifice is capped by an operculum formed by the anal plates. Eversion of the anal tube apparently is an adaptation for the excretion of honeydew beyond the wax test thus preventing possible contamination of the body. The shape of the anal ring and the number and placement of its wax pores may be of taxonomic value. However, we have avoided using these characters because they are difficult to see due to the large amount of sclerotization in the area.

The **Legs** are normally well developed. Each coxa has 1 pair of distal dorsolateral, and 1 pair of distal ventrolateral setae. The coxa also has a short seta on the proximal margin. The trochanter has 2 pores on each lateral surface, a short seta on the dorsal surface and a very long seta on the ventral surface. The femur is the longest leg segment and usually appears to be partially fused with the trochanter. The femur bears 1 pair of distal dorsolateral, and 1 pair of distal ventrolateral setae. The tibia is the second longest segment in most species and bears 3 distal setae: 1 ventral, 1 lateral, and 1 dorsal. Occasionally 1 or 2 setae may occur on the proximal third of the tibia. Tibiotarsal scleroses are absent from 6 species and present on 5, but there is no articulation between the tibia and tarsus. The tarsus is about 2/3 the length of the tibia. Three or 4 setae are located on the distal 3rd of each tarsus, 2 ventrolaterally and 1 or 2 dorsolaterally. The apex of each tarsus has 2 dorsal digitules which have expanded apices and which extend beyond the tip of the claw. The claw may be with or without a small subapical denticle. Each claw has 2 digitules, 1 arising from each lateroproximal margin. The apices of the digitules are expanded or knobbed, and are about equal (plate 1b) in size and shape in all but 4 species in which the apex of 1 digitule is at least 2 times larger than the other. The leg characters of taxonomic value at the species level are: the tibia/tarsus length ratio, the presence or absence of a tibiotarsal sclerosis, the size and shape of the claw digitules, and the presence or absence of a claw denticle.

The **Antennae** are 6- or 7-segmented. The third segment is the longest on 6-segmented antennae and at times is partially divided into 2 parts; the fourth segment of 7-segmented antennae is the longest. The number of segments is of some value in separating species. The 6 species which lack the tibiotarsal scleroses normally have 6-segmented antennae. A sensory pore is located on the

[1] For the purposes of this paper we have accepted Ferris' interpretation of abdominal segmentation, however, it is becoming increasingly evident that this concept may not be correct.

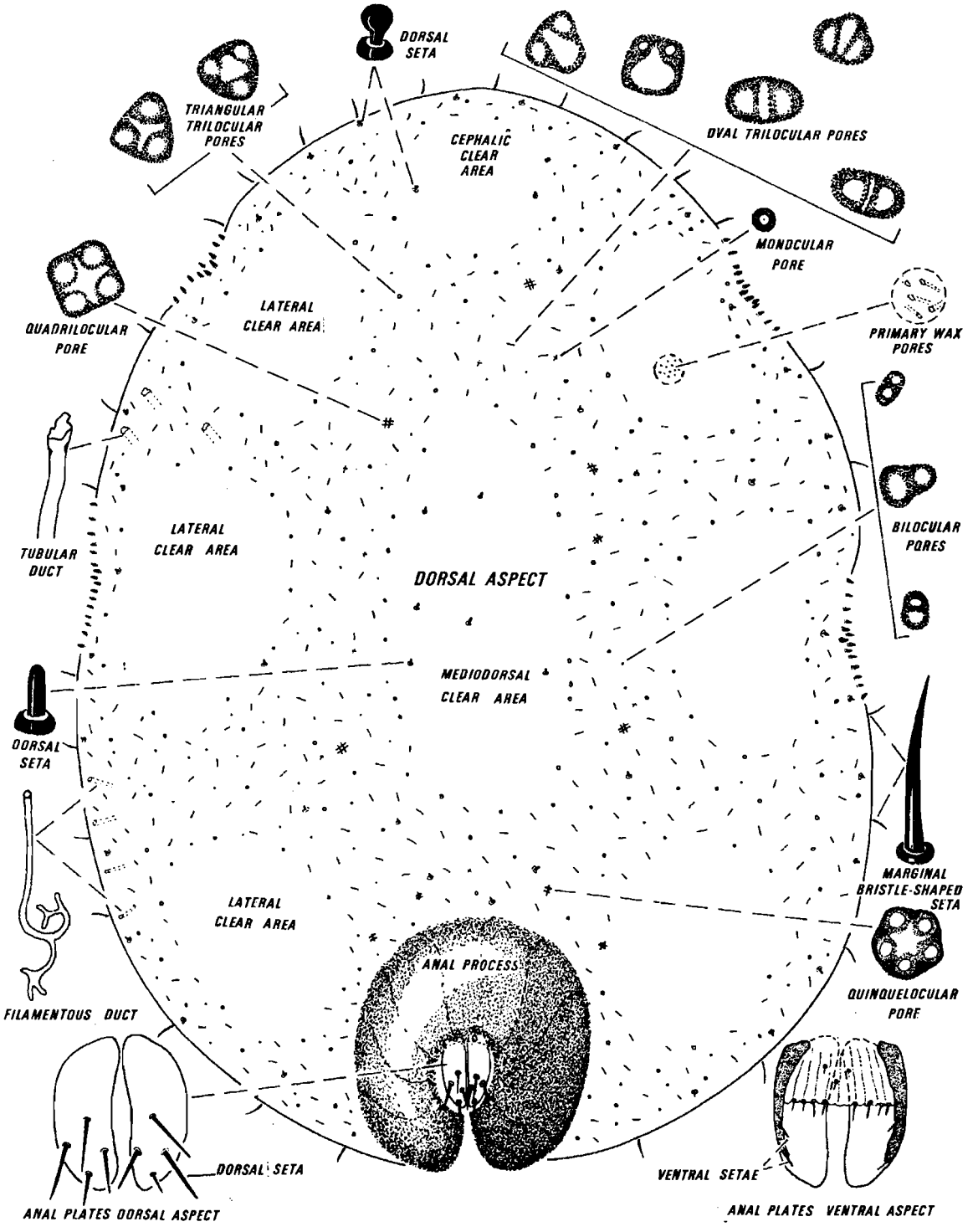


Figure 2. General morphology of slide mounted adult female dorsal aspect.

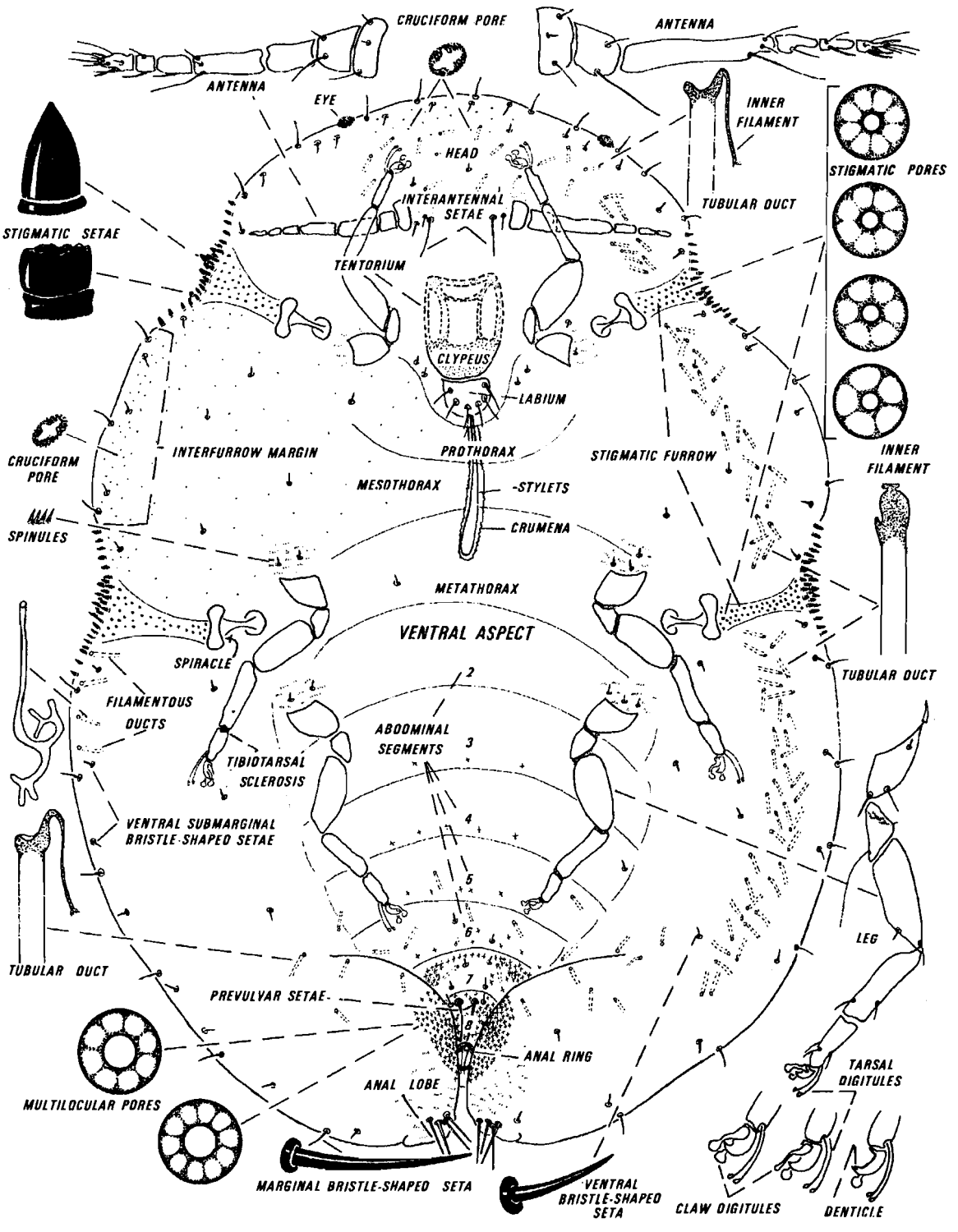


Figure 3. General morphology of slide mounted adult female, ventral aspect.

distal portion of antennal segment 2. The setal pattern is similar in all species examined. For 6-segmented antennae the number of setae per segment is as follows: 3 on segment 1, 2 on 2, 3 on 3, 1 on 4, 2 on 5, and 10 or 11 on segment 6. Seven-segmented antennae possess: 3 setae on segment 1, 2 on 2, 0 on 3, 3 on 4, 1 on 5, 2 on 6, and 10 or 11 on segment 7. The distal 3 segments have enlarged, fleshy, sensory setae. With the exception of the number of antennal segments, the antennae are of minor taxonomic importance.

The **Spiracles** are present on the thorax only. One pair is situated laterad and slightly posterior of the procoxae. The second pair lies in a similar position posterior to the mesocoxae. They are heavily sclerotized in all species examined and appear to be of little taxonomic importance.

The **Stigmatic Furrow** is the trough which extends from the atrium of each spiracle to the cluster of stigmatic setae which is situated on the margin. The furrow is lined with stigmatic pores and functions as an air passage between the spiracle and the exterior environment.

The **Interfurrow Margin** is the marginal area devoid of stigmatic setae, between the anterior and posterior stigmatic furrows. The relative length of the interfurrow margin, compared to the length of 1 of the clusters of stigmatic setae, is sometimes a useful secondary character.

The **Spinules** are small sclerotized teeth-like evaginations of the venter. Concentrations of spinules are present at the bases of the coxae and antennae and in the anal cleft area. These structures are present on all adult females of *Ceroplastes* and are apparently of no taxonomic value.

The **Clear Areas** are present on the dorsum as follows: 1 cephalic, normally 1 mediodorsal, 6 lateral, and 1 surrounding the anal process. The latter is difficult to see because it frequently is obscured by the sclerotized anal process. The mediodorsal area is absent on *ceriferus* and *floridensis*. The former species also has the cephalic and posterolateral areas divided by 1 or 2 irregular rows of pores. The species treated here normally possess 2-4 dorsal setae on the cephalic area; *rubens* Maskell and the species herein described as new also have many dorsal setae on the mediodoral area. The clear areas possess many minute simple pores which are only visible under high magnification (see plate 1c and 1d). Bedford (1968) referred to these pores as primary wax pores. We believe, as does Bedford, that they secrete the dry white wax. The clear areas are otherwise devoid of pores and setae. The characteristics of the clear areas are useful taxonomically.

The **mouthparts** are located near the posterior margin of the head. The obvious internal parts include the tentorium and the bases of the mandibles and maxillae. Externally, the clypeus appears as a slightly sclerotized band or shield anterior to the labium. The labium is 1-segmented and possesses 4 or 6 setae on the distoventral margin. The stylets are composed of 2 maxillae and 2 mandibles and form an internal loop which is encased within the crumena, with a portion sometimes protruding from the labium. During ecdysis the mouthparts are shed; this is evident because the mouthpart structure, including the stylets, is present on the shed exuviae. Prior to molting, the new instar inside the skin of the previous instar can be seen with its new mouthparts and coiled stylets. The mouthparts appear to be similar in all species examined.

The **Eyes** appear on the posterolateral margin of the head as slightly sclerotized oval processes. The 2 eyes normally protrude only slightly. In *rubens* they are apparently absent. The only taxonomic value of the eye tubercles is as a landmark from which to count other characters such as the marginal setae.

The **Setae** are the most important taxonomic character utilized for separating species of *Ceroplastes* treated in this study. In relative order of importance the 3 types of setae are: the enlarged stigmatic setae (see p. 4 for a discussion of this term), the cylindrical or conical dorsal setae, and the bristle-shaped marginal and ventral setae.

The **stigmatic setae** (figs. 4 and 5) on most species are located in a cluster laterad of each stigmatic furrow. First and second instars have 3 setae laterad of each stigmatic furrow; third instars have from 5-10. The number of stigmatic setae is, therefore, a useful character for the separation of third from first and second instars. Fourth instars have additional stigmatic setae which may range from 6 to over 300 laterad of each stigmatic furrow. The adult females of some species have these setae in tight clusters which are confined to the stigmatic furrows. In others the clusters are more elongate and extend along the margin on either side of the stigmatic furrows or are arranged in a triangular cluster with the setae extending onto the dorsum. The setae within each cluster may be arranged in 3-7 irregular rows. The shape and size of the stigmatic setae are often characteristic of the species.

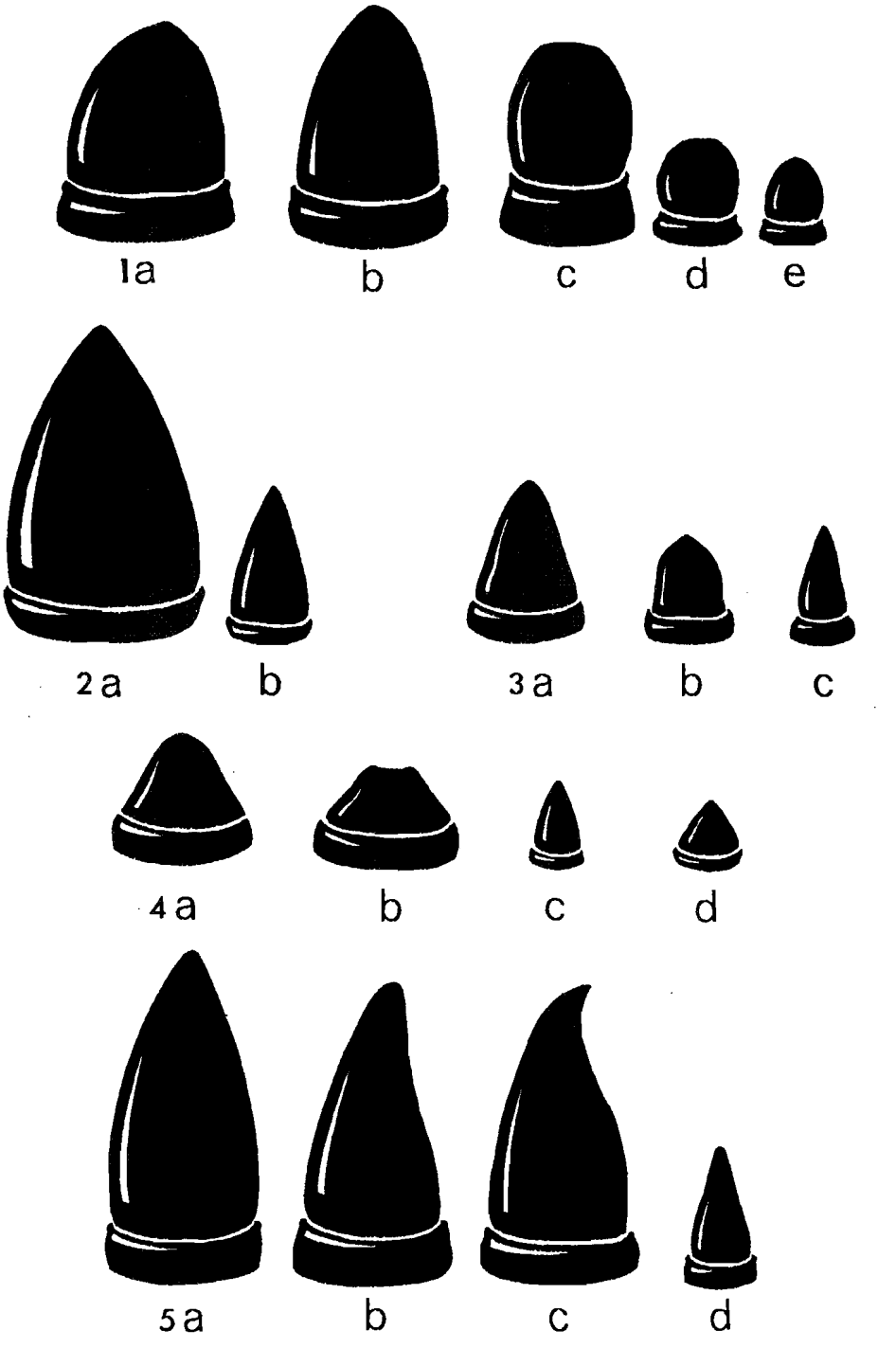


Figure 4. Stigmatic setae: 1. *brachyurus*. 2. *ceriferus*. 3. *cirripediformis*. 4. *cistudiformis*. 5. *dugesii*.

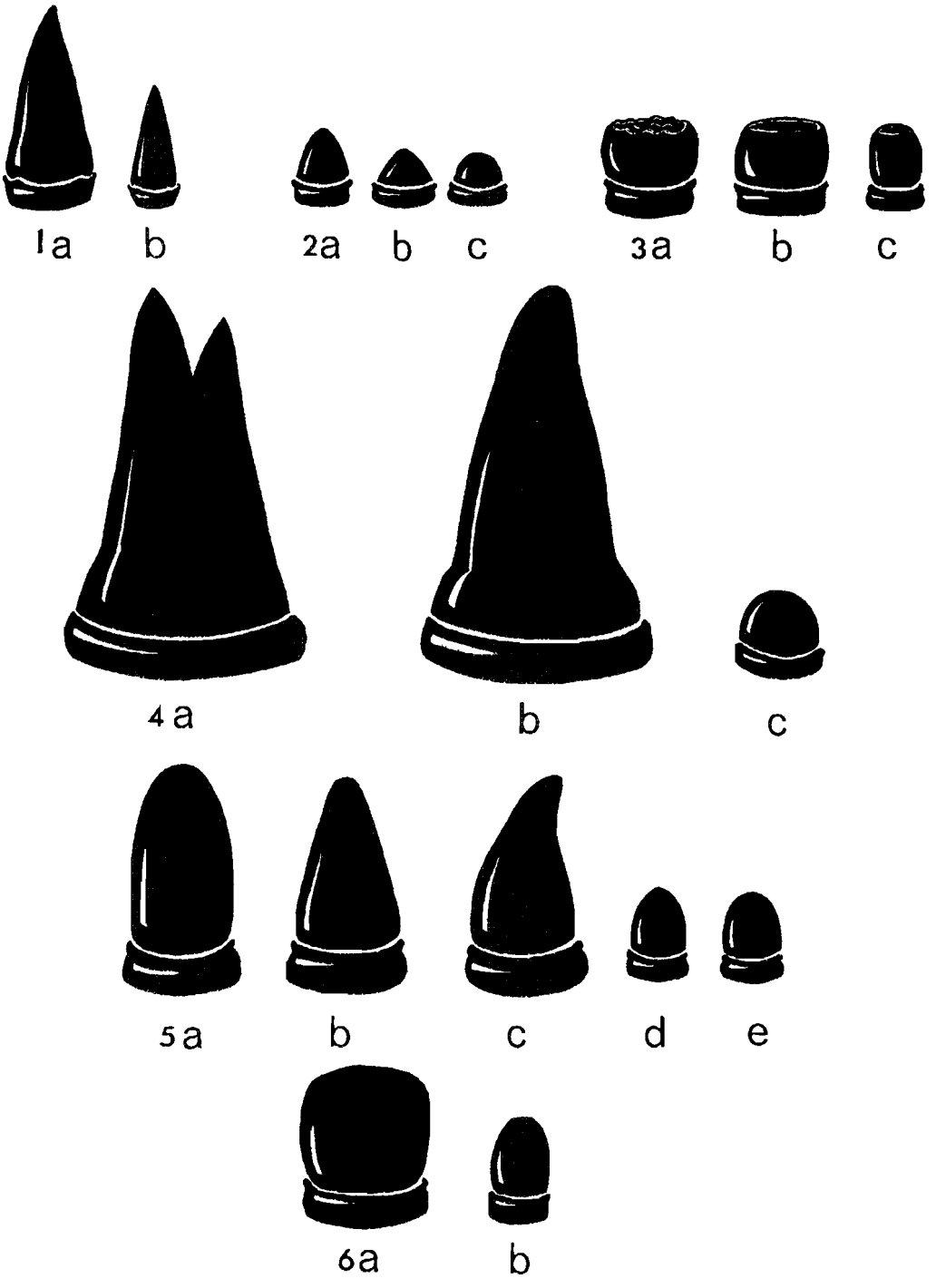


Figure 5. Stigmatic setae: 1. *floridensis.* 2. *irregularis.* 3. *nakaharai.* 4. *rubens.* 5. *sinensis.* 6. *utilis.*

The **dorsal setae** (figs. 6 and 7) are 3.0 - 15.0 μ long, cylindrical or conical, and have various types of apices which range from capitate to pointed. Most species have a dorsal submarginal row in addition to those scattered on the dorsum. Taxonomically, the dorsal setae are useful as primary or secondary characters.

The **marginal bristle-shaped setae** are 16.0 - 56.0 μ long, with pointed apices and are arranged in a single row along the body margin. The placement of these setae is rather constant in most *Ceroplastes* species with 6 between the eye tubercles, 2 between each eye tubercle and each anterior stigmatic furrow, 3 or 4 between each anterior and posterior stigmatic furrow, and 10 between each posterior stigmatic furrow and the anal cleft. However, *rubens* lacks the marginal setae except the 4 or 5 which are located in a cluster on each anal lobe. On *floridensis* the marginal setae are more numerous than normal, with about: 18 between the eye tubercles, 9 between each eye tubercle and each anterior stigmatic furrow, 9 between each anterior and posterior stigmatic furrow, and 40 between each posterior stigmatic furrow and the anal cleft. In *irregularis, utilis* Cockerell, and the species herein described as new, there appear to be more marginal setae than normal, but in each case the ventral submarginal setae are unusually large, giving the illusion of 2 irregular rows of marginal setae.

The **ventral setae** are bristle-shaped and vary in length depending upon their placement. For example, the submarginal setae are about 15.0 μ long, while the mesal interantennal and prevulvar setae are normally 40.0 - 80.0 μ long. As previously mentioned, 3 species have abnormally long ventral submarginal setae. The number of ventral submarginal setae seems to be constant at about 70. Short ventral setae occur in clusters in the cephalic area, near the base of each coxa, and scattered on the thoracic and abdominal segments. One pair of long setae is situated just anterior to the vulva on segment 8 (prevulvar setae), and another long pair is located mesally between the antennae (mesal interantennal setae). The prevulvar setae are surrounded by 2 - 8 short bristle-shaped setae. One or 2 short lateral interantennal setae are associated with each mesal interantennal seta. The ventral setae are of minor taxonomic importance at the species level.

The **Dorsal Pores** are secondary taxonomic characters that are not always reliable for the separation of *Ceroplastes* species. These pores have from 1-5 loculi and are referred to as: monolocular ring, bilocular, oval trilocular, triangular trilocular, quadrilocular, and quinquelocular pores (fig. 2). **Monocular ring pores** have 1 round locule which is surrounded by a sclerotized rim. These pores are small and never abundant and therefore are often overlooked. Monolocular pores, when present, are mainly located in the mesal area. **Bilocular pores** have 2 loculi which are separated by a sclerotized bridge. The 2 loculi may vary from round to crescent shaped and may be about equal in size and shape or 1 may be 2 or 3 times as large as the other. These pores are normally surrounded by a heavily sclerotized rim and vary from oval to round in outline. Bilocular pores are concentrated near the submargin on some species and are evenly distributed on others. **Oval trilocular pores** each possess 3 linearly arranged loculi which are separated by membranous or slightly sclerotized bridges. The central locule is normally oval, but varies from rectangular to teardrop-shaped, and the lateral loculi are normally crescent shaped, but vary from oval to round. This type of pore is surrounded by a heavily sclerotized rim and varies from oval to round in outline. In *rubens* and *utilis* these pores are so misshapen that they hardly resemble oval triloculars. In most instances it is the central orifice that is distorted, at times being 4 or 5 times larger than normal. In *ceriferus* and *floridensis* the central locule of some pores is narrow and appears as a bar separating the 2 lateral loculi. Oval trilocular pores are normally evenly distributed. **Triangular trilocular pores** each possess 3 round loculi which are arranged in a circle around a central triangular loculus (plate 2a). This type of pore is surrounded by a heavily sclerotized rim and is triangular to oval in outline. Triangular trilocular pores are normally evenly distributed, but are mainly located in the mesal area on species that possess limited numbers of these pores. **Quadrilocular pores** each possess 4 round loculi which are arranged in a circle around a central square or stellate loculus. This type of pore is surrounded by a heavily sclerotized rim and is square to oval in outline. Quadrilocular pores, when present, are normally most numerous in the mesal area. **Quinquelocular pores** each possess 5 round loculi which are arranged in a circle around a central round or pentagonal loculus. This type of pore is surrounded by a heavily sclerotized rim, is round in outline, and is often with a lobe opposite each locule. Quinquelocular pores, when present, are found anterior to the anal process and occasionally in the cephalic area. Occasionally, specimens of *Ceroplastes* have a few **unusual dorsal pores**. In *brachyurus* Cockerell some specimens have pores similar in size and shape to quinquelocular pores, but possess 6 loculi. On other species, pores which are

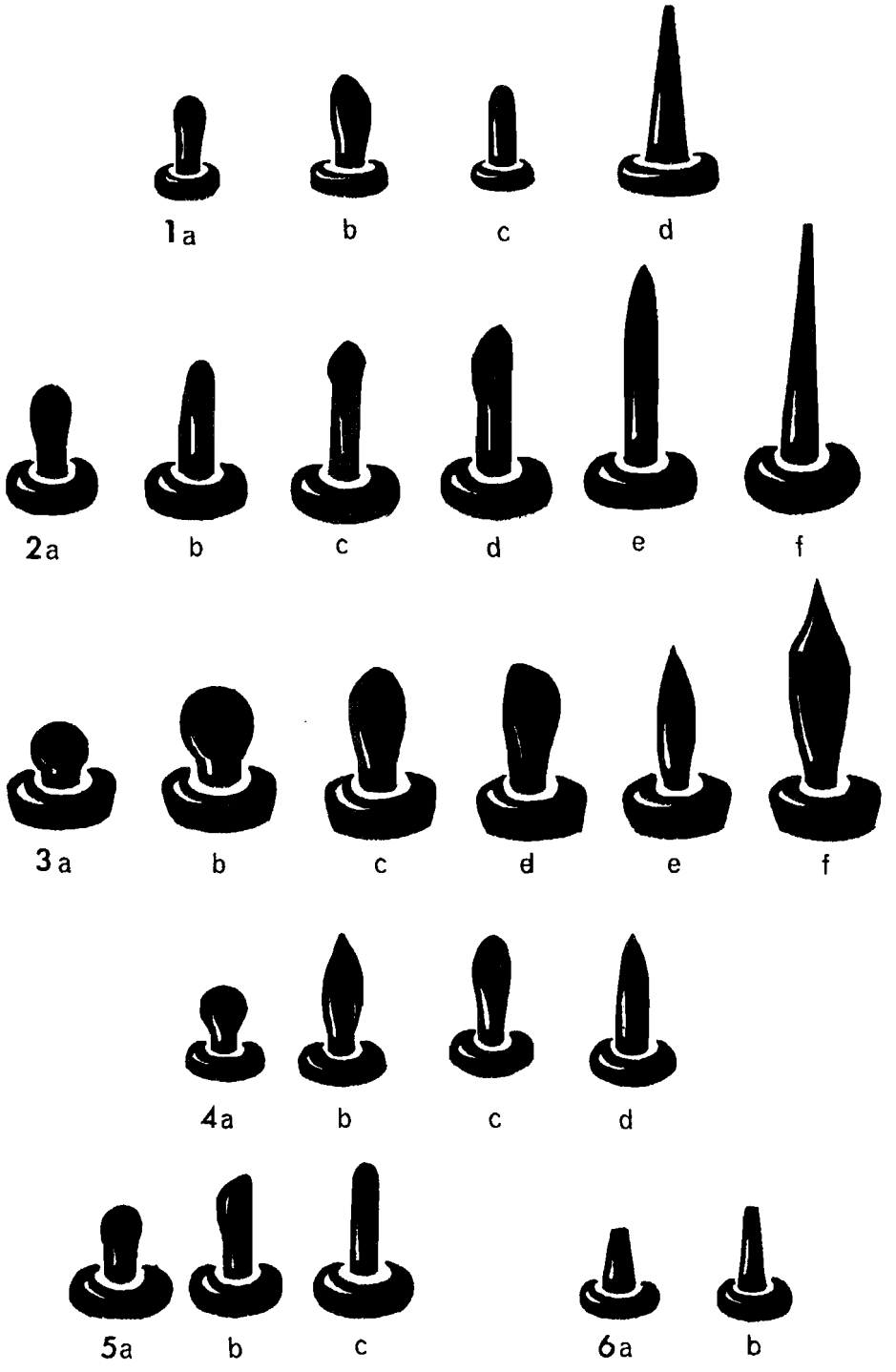


Figure 6. Dorsal setae: 1. *brachyurus.* 2. *ceriferus.* 3. *cirripediformis.* 4. *cistudiformis.* 5. *dugesii.* 6. *floridensis.*

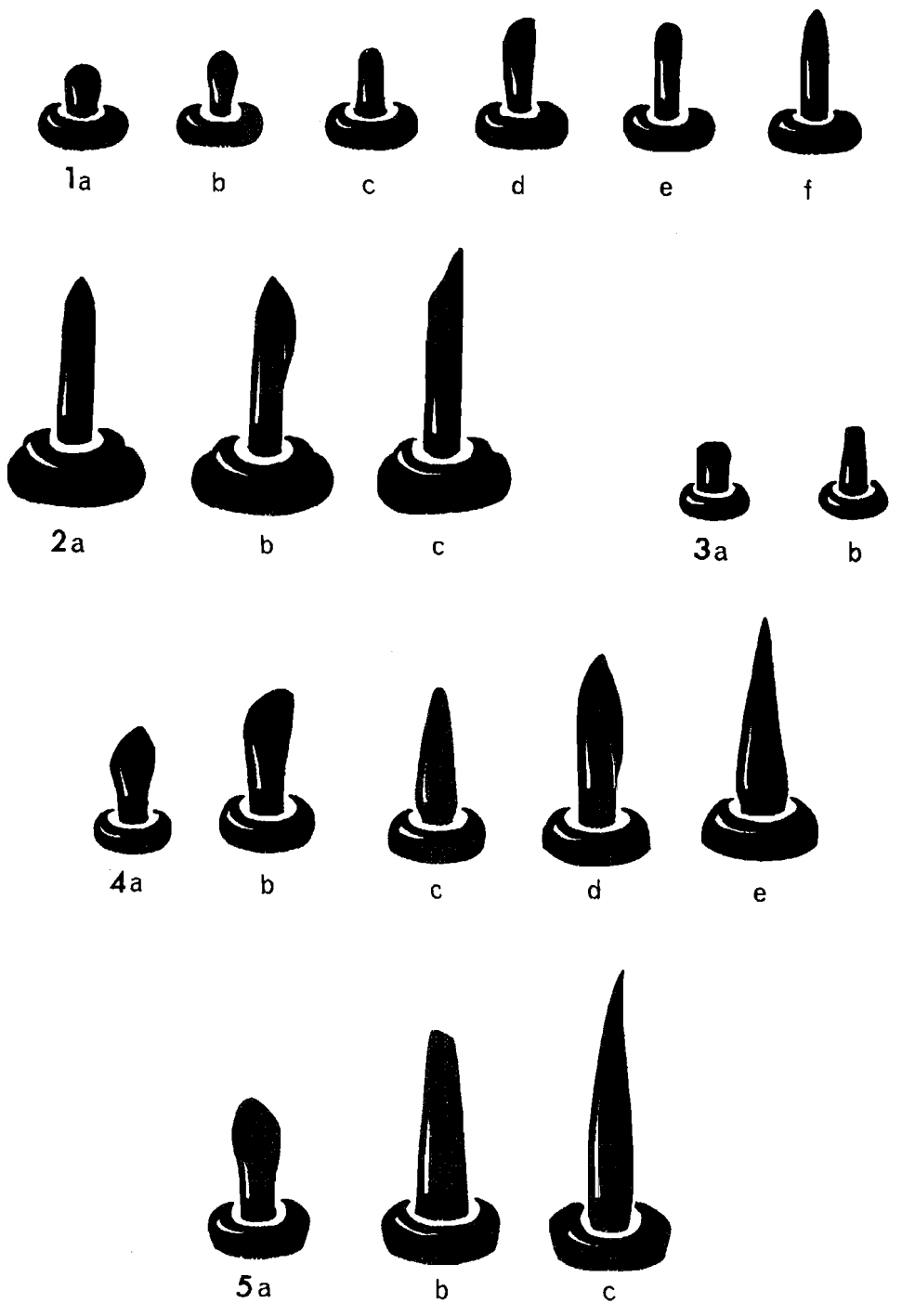


Figure 7. Dorsal setae: 1. *irregularis*. 2. *nakaharai*. 3. *rubens*. 4. *sinensis*. 5. *utilis*.

obviously aggregates of 2 or more separate pores are sometimes observed. Normally these aggregations are made up of 2 oval trilocular pores, but other combinations rarely occur, e.g., 1 oval trilocular and 1 triangular triloculàr. With few exceptions, the dorsal pores are of little importance in separating species of *Ceroplastes* in the U.S.

Normally the relative abundance or even presence or absence of a particular pore type is of limited usefulness. For example, some specimens of *cistudiformis* Cockerell are totally without triangular trilocular pores while others may have as many as 900; some specimens of *brachyurus* lack quinquclocular pores and others may have more than 10. However, in *rubens* and the species herein described as new, the unusually large number of bilocular pores relative to the number of other pore types is a useful secondary character for separating them from other species of *Ceroplastes*.

The **Ventral Pores** are secondary taxonomic characters, some of which are useful in the separation of *Ceroplastes* species. These pores have from 1-14 loculi and are referred to as: cruciform, stigmatic, or multilocular pores (fig. 3). **Cruciform pores** have 1 cross-shaped locule which is surrounded by a heavily sclerotized rim that is oval in outline. These pores are concentrated on the submargin and become less numerous mesally. **Stigmatic pores** have from 4-10 oval to trapizoidal loculi which are arranged in a circle around a central circular loculus (plate 2b). This type of pore is surrounded by a heavily sclerotized rim and is round in outline. Stigmatic pores line the stigmatic furrows from the atrium of the spiracles to the stigmatic setae. **Multilocular pores** have from 6-14 (normally 10) oval to rectangular loculi which are arranged in a circle around a central circular loculus. This type of pore is surrounded by a heavily sclerotized rim and is round in outline. Multilocular pores are concentrated around the vulva and become less numerous on anterior abdominal segments. In some species these pores are present near the base of each coxa.

The only ventral pores which are useful taxonomically in the separation of *Ceroplastes* species treated here, are the multilocular pores. Their distribution is sometimes characteristic of the species. In some species these pores are restricted to the posterior abdominal segments, while in others, they are present on all abdominal and posterior thoracic segments.

The **Dorsal Tubular Ducts** are simple membranous tubes each possessing a lightly sclerotized ring near the dermal orifice. These ducts are scattered over the dorsum, and of the species treated here, are present only on *rubens*.

The **Ventral Tubular Ducts** are composed of a tube with a simple dermal orifice (plate 2c) at 1 end and a slightly enlarged cup at the other; an inner filament arises from the rim of the cup and terminates in a rosette. This filament may be as long as, and much narrower than the basal portion of the tube, or it may be short and as wide as the basal portion of the tube. The tubular ducts on *floridensis* have a wide inner filament which forms an asymmetrical cup. Clusters of tubular ducts are normally found in the cephalic and vulvar regions; rarely a few specimens of a species may possess 1 or 2 ducts on the anterior abdominal segments or on the submargin between the anterior and posterior stigmatic furrows. The tubular ducts of *floridensis* are unusual in their distribution, occurring in a ventral submarginal band from the eye tubercles to the anal cleft, interrupted only by the stigmatic furrows.

Filamentous Duct is a term first used by Kawai and Tamaki (1967) which applies to slender branched tubules which empty through a simple sclerotized dermal orifice. These minute structures occur on the submargin of *ceriferus* and *sinensis* and are useful in separating these species from the other species of *Ceroplastes*.

GENUS *CEROPLASTES* GRAY
ADULT FEMALE

Ceroplastes
Gray, 1828, p. 7.
Type-species: *Coccus (Ceroplastes) janeirensis* Gray, 1828.
Designated by Fernald, 1903.

Columnea Targioni-Tozzetti, 1866, p. 131.
Type-species: *Coccus caricae* Fabricius, 1794.
Targioni-Tozzetti, 1867. By subsequent restriction.

Lacca Signoret, 1869. p. 848.
Type-species: Lacca alba Signoret, 1869. By montypy.

Gascardia Targioni-Tozzetti, 1893, p. 88.
Type-species: *Gascardia madagascariensis* Targioni-Tozzetti,
1893. By monotypy.

Ceroplastidia Cockerell, 1910, p. 76.
Type-species: *Ceroplastes (Ceroplastidia) bruneri* Cockerell
and Cockerell *in* Cockerell, 1902. By original designation.
Baccacoccus Brain, 1920, p. 127.
Type-species: *Baccacoccus elytropappi* Brain, 1920. By original
designation and monotypy.
Cerostegia De Lotto, 1969, p. 211.
Type-species: *Ceroplastes rufus* De Lotto, 1966. By original
Designation. [New synonymy]

It is our belief that *Gascardia* should be treated as a subjective, junior synonym of *Ceroplastes. Gascardia* was returned to senior synonym status by DeLotto (1965) for species previously placed in *Ceroplastes* which have "stigmatic spines set in more or less compact groups which extend from the stigmatic clefts towards the dorsum." We have had serious difficulty determining the limits of *Gascardia*. In species such as *dugesii* and *floridensis* the clusters of stigmatic setae could, by no stretch of the imagination, be considered as forming compact groups; on the other hand, the stigmatic setal groups of *cistudiformis, irregularis,* and *utilis* are without doubt compact; but what about such species as *cirripediformis, brachyurus,* and *sinensis*? Do they possess compact stigmatic setal groups? If a large series of specimens of *cirripediformis* is examined, it will be noted that those specimens with small numbers of stigmatic setae, have these setae arranged in relatively compact clusters; whereas, those specimens which have relatively large numbers of stigmatic setae have these setae dispersed over a relatively large area of the stigmatic margin. There seems to be no distinct gap between those species which possess "more or less" compact groups of stigmatic setae and those which do not. In regard to the character "which extend from the stigmatic cleft towards the dorsum" we have also had problems. In species such as *ceriferus, cistudiformis, dugesii,* and *irregularis* the clusters of stigmatic setae would qualify, in our minds, as extending "towards the dorsum", but how far "towards the dorsum" must they go? In *sinoiae* Hall, a species placed in *Gascardia* by DeLotto (1965), the stigmatic setae seem to be less projected "towards the dorsum" than on species such as *cistudiformis* or *irregularis.* On *brachyurus* and *sinensis* the stigmatic clusters extend "towards the dorsum" less than on *cistudiformis* and *irregularis*, but more than on *utilis* and *floridensis.* Based on the fact that the relative size and shape of the stigmatic setal clusters seem to vary from large to small, compact to loose, and present on the dorsum to absent on the dorsum, with many intermediates, we feel that *Gascardia* should be treated as a junior, subjective synonym of *Ceroplastes.*

It is also our belief that *Cerostegia* DeLotto should be placed as a junior, subjective synonym of *Ceroplastes.* DeLotto (1969) described the genus for species previously included in *Ceroplastes* which possess tubular ducts with the inner filament expanded. The genus includes 3 species: *floridensis, japonica* (Green), and *rufa* (DeLotto). We do not believe that this is a monophyletic group of species since *rufa*, by no stretch of the imagination, could be construed as closely related to *floridensis* and *japonica*. The only salient feature, other than the tubular ducts, shared by all 3 species is the absence of a dorsomedial clear area and this feature is also present on species included in *Ceroplastes* (e.g., *ceriferus*) and *Gascardia* (e.g., *deceptrix* DeLotto). The differences between *rufa* and the 2 species *floridensis* and *japonica* are numerous. *C. rufa* has: stigmatic setae around the entire body margin; reduced legs, with the tibia and tarsus almost completely fused; claw digitules with their apices only slightly enlarged. The other 2 species have: stigmatic setae restricted to the body margin in and near the stigmatic furrows; legs well developed, with the tibia and tarsus distinct; claw digitules with their apices conspicuously enlarged. Furthermore, cursory studies of the immatures, show that *ceriferus* and *floridensis* are very closely related. First instars of these species can be separated only on the basis of very minor characters. Based on the similarity of *ceriferus* and *floridensis* and the dissimilarity of *floridensis* and *rufa* it seems advisible to us to consider *Cerostegia* as a junior, subjective synonym of *Ceroplastes.*

Lindinger (1973) designated *chilensis* Gray as the type of *Ceroplastes,* but this designation is not valid because it is predated by the Fernald, 1903 designation.

According to Vilar (1951) the genus *Calypticus* Costa (type-species: *Coccus hesperidum* Linnaeus, 1758) is a junior synonym of *Ceroplastes*, however, it evidently has no relationship to *Ceroplastes*, but is a junior, objective synonym of *Coccus* Linnaeus.

In 1910 *Ceroplastina* Cockerell (type-species: *Ceroplastes (Ceroplastina) lahillei* Cockerell, 1910) was described as a subgenus of *Ceroplastes.* Unfortunately, no material of *lahillei* has been available for examination and we therefore have been unable to determine the exact status of *Ceroplastina,* although it probably is a junior synonym of *Ceroplastes.*

GENERIC DIAGNOSIS – Adult females roughly oval, 1.0-20.0 mm long. Body with thick wax test which may be globular or divided into distinct plates. With band of dry white wax from atrium of each spiracle through stigmatic furrow, around body margin, and onto submarginal area of dorsum. Derm membranous in young specimens, sclerotized in older females. With 2 well developed anal plates borne at apex of a heavily sclerotized anal process which is pad-like or extended into tubercle. Antennae well developed usually with 6 or 7 segments. Legs well developed in most species. Claws with or without small denticle and either 2 stout digitules with broadly expanded apices nearly equal in size, or 1 digitule with broad apex and 1 with reduced apex. Stigmatic setae usually confined to marginal area laterad of stigmatic furrows, but extending onto dorsum or around entire body margin on some species. Number of stigmatic setae variable, always with more than 4 laterad of each stigmatic furrow of adult female. Bristle-shaped setae present along body margin, except on *rubens* and on venter, with 1 or 2 long pairs in interantennal space and another pair anterior to vulva on eighth abdominal segment. With 7 - 9 dorsal clear areas. Dorsal setae variable in size and shape (figs. 6 and 7), but normally cylindrical or conical. Dorsal pores with 2 - 6 loculi, scattered over dorsum. Multilocular pores with 6 - 14 loculi, concentrated in vulvar area, extending anteriorly to prothorax on some species. Stigmatic pores present in irregular rows in stigmatic furrows normally with 5 loculi, occasionally with as many as 10. Cruciform pores present over venter, most abundant on submargin. Normally with tubular ducts on venter in cephalic and/or vulvar regions, occasionally on submargin. Several species with irregular row of filamentous ducts around dorsal and/or ventral submargin.

DISCUSSION – The genus *Vinsonia* Signoret is related to *Ceroplastes*, in fact, Lindinger (1937) synonymized *Vinsonia* with *Ceroplastes*. Most workers have considered *Vinsonia* a valid genus. *Vinsonia* is separated from *Ceroplastes* by the presence of 5 - 10 pairs of long setae in the interantennal space, whereas *Ceroplastes* species usually have only 1 long pair of setae in this area. *Vinsonia* also lacks dorsal pores of the *Ceroplastes* type.

Waxiella DeLotto is also closely related to *Ceroplastes* but differs in possessing 2 distinct types of stigmatic setae.

KEY TO THE WAX TESTS OF EIGHT ADULT FEMALE *CEROPLASTES* IN THE UNITED STATES

The following species are not included because suitable material has not been available: *brachyurus, cistudiformis, utilis.*

Identifications made using this key should be considered tentative since the wax tests of some adult females change in size, shape, and color with age. Although we have included much variation, we have not always seen enough fresh material to be certain of all differences. Only fresh material should be used when keying specimens in this key. Dry and alcohol-preserved specimens often become discolored and disfigured.

1.	Posterior stigmatic wax bands absent; commonly collected on *Atriplex* and *Artemesia* in the western U.S.	*irregularis* Cockerell
	Posterior stigmatic wax bands present; rarely collected on *Atriplex* and *Artemesia*	2
2.(1)	Wax test yellowish, flattened, with a large dorsomedial ridge in young females; with a dorsomedial furrow in mature specimens; lateral wax filaments broad, apically fringed (figs. 25,26)	*nakaharai* Gimpel, n. sp.
	Wax not yellow, test usually convex; normally without ridges or furrows dorsomedially, occasionally with a small ridge (figs. 12,30,31); lateral wax filaments narrow, apically pointed	3
3.(2)	Anterior stigmatic wax bands produced anteriorly, nearly meeting on cephalic submargin (fig. 28)	*rubens* Maskell
	Anterior stigmatic wax bands produced dorsally, absent from cephalic submargin	4

4.(3) Wax divided into definite plates; each plate with a central dark nucleus 5
Wax normally not divided into plates; if with plates, these without nuclei 6

5.(4) Posterolateral wax filaments each with a bifid apex (fig. 12) . . . *cirripediformis* Comstock
Posterolateral wax filaments each with a simple apex (fig. 30) . . . . . *sinensis* Del Guercio (in part)

6.(4) Wet wax dorsally with an anterior horn; dry wax absent dorsomedially (fig. 10) . . . . . *ceriferus* (Fabricius)
Wet wax without a horn; dry wax present dorsomedially 7

7.(6) Wet wax reddish-brown (fig. 31) . . . . . *sinensis* Del Guercio (in part)
Wet wax white or white with a pink tinge 8

8.(7) Wet wax volcano-shaped or hemispherical, with dorsomedial dry wax tilting anteriorly; posterolateral wax filaments simple (fig. 17). . . . *dugesii* Lichtenstein
Wet wax either flattened or hemispherical, with dorsomedial dry wax not tilting or tilting posteriorly; posterolateral wax filaments each with a bifid apex (figs. 20,21) . . . . . *floridensis* Comstock

KEY TO SLIDE MOUNTED ADULT FEMALE *CEROPLASTES* IN THE UNITED STATES

1. Tibiotarsal scleroses present; antennae normally 7-segmented 2
Tibiotarsal scleroses absent; antennae normally 6-segmented 6

2.(1) Stigmatic setae present around entire body margin . . . . . *dugesii* Lichtenstein
Stigmatic setae confined to margin laterad of stigmatic furrows 3

3.(2) Filamentous ducts present on ventral submargin; anal plates each with 2 ventral setae . . . . . *sinensis* Del Guercio
Filamentous ducts absent; anal plates each with 1 ventral seta 4

4.(3) Multilocular pores absent on anterior abdominal segments and thorax; without dorsal capitate setae . . . . . *brachyurus* Cockerell
Multilocular pores present on anterior abdominal segments and thorax; with or without dorsal capitate setae 5

5.(4) Stigmatic setae arranged in 3 irregular rows, predominatly isosceles . . . . . *cirripediformis* Comstock
Stigmatic setae arranged in 5-6 irregular rows, predominatly equilateral . . . . . *cistudiformis* Cockerell

6.(1) Stigmatic setae predominantly with truncate apices 7
Stigmatic setae predominantly with rounded or pointed apices 8

7.(6) With 18-32 stigmatic setae laterad of each stigmatic furrow; anal process rounded anteriorly, never extending to thorax; with 1 ventral seta on each anal plate; mediodorsal clear area without setae . . . . . *utilis* Cockerell
With 6-9 stigmatic setae laterad of each stigmatic furrow; anal process truncate anteriorly, extending forward to thorax on older adult females; with 3 ventral setae on each anal plate; mediodorsal clear area with several setae . . . . . *nakaharai* Gimpel, n. sp.

8.(6) Mediodorsal clear area present 9
Mediodorsal clear area absent 10

9.(8) Stigmatic setae absent on margin laterad of posterior stigmatic furrows; legs well developed; ventral tubular ducts present; mediodorsal clear area without setae. . . . . *irregularis* Cockerell
Stigmatic setae present on margin laterad of posterior stigmatic furrows; legs reduced; ventral tubular ducts absent; mediodorsal clear area with several setae . . . . . *rubens* Maskell

10.(8) With 28-88 stigmatic setae laterad of each stigmatic furrow, arranged in 6 irregular rows; with about 10 marginal bristle-shaped setae between anterior stigmatic furrows; tubular ducts with narrow inner filament, present in cephalic and vulvar areas, absent in submarginal areas; with filamentous ducts present on dorsal and ventral submargins . . . . . *ceriferus* (Fabricius)

With 22-34 stigmatic setae laterad of each stigmatic furrow; arranged in 3 irregular rows; with about 36 marginal bristle-shaped setae between anterior stigmatic furrows; tubular ducts with broad inner filament, present in submarginal band from near eye to slightly anterior of anal cleft, absent from cephalic and vulvar areas; filamentous ducts absent . . . . . *floridensis* Comstock

DESCRIPTION OF ADULT FEMALES

Ceroplastes brachyurus Cockerell
Suggested Common Name: Brachyuran Wax Scale
Figures 4(1), 6(1), 8.

Ceroplastes brachyurus Cockerell, 1903, p. 157.

TYPE DATA – The type locality is Zapotlan, Mexico. The type host according to Cockerell (1903), is a shrub with small pinnate leaves like *Rhus* sp. Cockerell did not designate a holotype specimen in his original description of this species. One adult female mounted on a slide labeled "From type material" is in very poor condition. A series of 6 slides was mounted from dry syntype material from a box labeled, "10605:-Ceroplastes brachyurus, on Rhus-like shrub (wild) Zopotlan, Jalisco, Mex.–T. & B. Cy. # 10.-Rec'd July 1903." We here designate as lectotype the specimen numbered 6 (1 adult female on 1 slide). The label on this slide has the following information: "Lectotype *Ceroplastes brachyurus* Ckll. Ex. *Rhus*-like shrub VII-6-1903 Townsend col. Zapotlan, Jalisco, Mex. DET. W. F. GIMPEL Mounted Ex dry mat. 1971." We designate the remaining 5 slides as paralectotypes. Unmounted dry paralectotypes are in a box labeled with the information given above. The lectotype and paralectotypes are deposited in the USNM.

FIELD CHARACTERS – The following description is based on alcohol preserved specimens.

Test: wet wax roughly oval in dorsal view, hemispherical laterally, without horn, grayish white, with small marginal flange not hiding lateral filaments, not divided into plates, without nuclei. Dry wax filaments not seen; dorsal dry wax of first and second instars forming small central cap, not surrounded by dorsomedial nucleus, dorsal dry wax not tilted. Stigmatic wax bands present near both pairs of spiracles, anterior bands apparently directed dorsally, filamentous wax confined to stigmatic areas. Length 4.0 mm (2.0-5.5), width 3.5 mm (1.5-5.0), height 2.5 mm (1.5-3.0).

Body: elliptical, reddish brown; anal process short.

SLIDE MOUNTED CHARACTERS – Adult female elliptical, length 3.0 mm (1.0-4.5), width 2.5 mm (1.0-3.5).

Dorsum: membranous in young adult females, slightly sclerotized in older adult females; with 1 cephalic, 1 mediodorsal, and 6 lateral clear areas devoid of pores and setae, except cephalic area with 1 or 2 cylindrical setae; dorsal setae variable (fig. 6 (1)) about 82.0 cylindrical or conical setae with bluntly rounded apices, 4.4 μ (3.8-8.7) long. Dorsal pores distributed as follows: about 120 bilocular pores concentrated on submargin; about 300 oval trilocular pores, more numerous toward submargin, 710 triangular trilocular pores evenly distributed; about 50.0 quadrilocular pores mainly located in mesal area; occasionally with a few quinquelocular and/or hexalocular pores. Tubular ducts absent. Anal plates each with 1 ventral and 4 dorsal setae.

Margin: marginal bristle-shaped setae 34.3 μ (24.0-42.0) long placed as follows: 8.0 (5.0-9.0) between eye tubercles, 3.0 (1.0-4.0) between each eye tubercle and each anterior stigmatic furrow, 4.0 (2.0-5.0) between each anterior and posterior stigmatic furrow, 10.0 (9.0-11.0) between each posterior stigmatic furrow and anal cleft, last 3 or 4 longer, 30.0 μ (26.2-32.8), in cluster on anal lobes; stigmatic setae hemispherical to

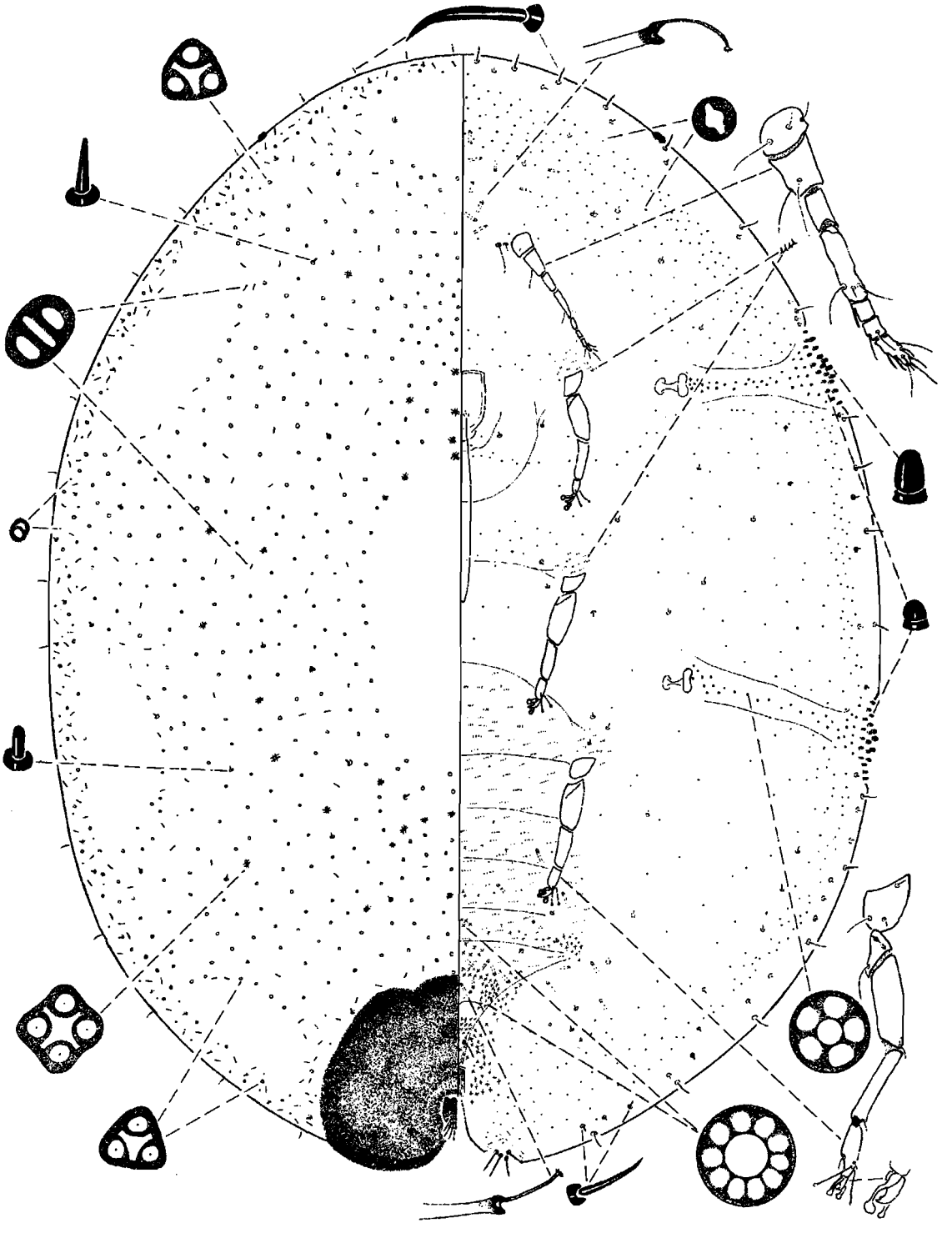


Figure 8. *Ceroplastes brachyurus.* Slide mounted adult female. Mexico: Coahuila, Monclova (III-20-1967, *Citrus* sp.).

bullet-shaped with rounded or truncate apices (fig. 4(1)), length 1.0-1.5 times greater than width at base, 16.0 (13.0-22.0) laterad of each stigmatic furrow in 4 to 5 irregular rows, length from 7.8-16.5 μ long. Filamentous ducts absent. Eye tubercles slightly protruding.

Venter: membranous; bristle-shaped setae placed as follows: 30.0 (25.0-33.0) on each submargin, 9.3 μ (6.9-10.9) long, 2.0 (1.0-4.0) associated with each coxa, 4.0 (2.0-6.0) in cephalic region, 4.0 (2.0-12.0) on each abdominal and thoracic segment; interantennal space with 1 pair of lateral bristle-shaped setae 25.2 μ (10.9-32.8) long, 1 pair of mesal bristle-shaped setae 64.2 μ (51.8-76.4) long; 1 pair of mesal bristle-shaped setae 85.6 μ (69.8-100.0) long on segment 8 anterior to vulva, surrounded by 2 or 3 pairs of short bristle-shaped setae 8.5 μ (5.0-10.1) long. About 1,025 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous towards meson; 40.0 (30.0-90.0) stigmatic pores in irregular band in each stigmatic furrow, extending from spiracular atrium to stigmatic setae, most furrows predominantly with quinquelocular pores, nearly always with several pores with more than 5 loculi; about 250 multilocular pores surround vulva, 72.0 (64.0-87.0) on seventh abdominal segment, 55.0 (42.0-63.0) on sixth abdominal segment, 4.0 (3.0-7.0) on fifth and fourth abdominal segments, absent on preceding abdominal and thoracic segments. Tubular ducts with slightly asymmetrical cups, each duct with inner filament nearly as long and much narrower than basal part of duct, arranged in 2 clusters as follows: 16.0 (14.0-22.0) in cephalic region; 30.0 (24.0-37.0) in region of vulva, occasionally on anterior abdominal segments, legs 380.0 μ (330.0-430.3) long; tibia without basal setae, tibia less than 2 times length of tarsus, with tibiotarsal scleroses; tarsal digitules 51.5 μ (46.0-53.2) long; with equal claw digitules 29.6 μ (26.2-32.8) long; claws without denticles; length of leg segments as follows: coxa 63.7 μ (55.0-66.0), trochanter plus femur 160.0 μ (144.0-170.3), tibia 104.0 μ (96.0-110.0), tarsus 64.5 μ (50.2-74.0), claw 19.8 μ (17.5-22.0). Antennae 7-segmented, occasionally 6-segmented, 265.0 μ (243.0-283.0).

SPECIMENS EXAMINED – **Alabama:** Baldwin Co., Gulf Shores (I-12-1944, *Ilex* sp., Mayer), 1 slide, 5 specimens (USNM).

Arizona: Santa Cruz Co., near Ruby, Sycamore Canyon (IV-18-1966, *Bouvardia "glaberrina,"* J. E. Gilbert), 5 slides, 5 specimens (USNM).

FOREIGN SPECIMENS EXAMINED – **Mexico:** Coahuila, Monclova (111-20-1967, *Citrus* sp., C. Payne, 1 slide, 1 specimen (USNM); Jalisco, Zapotlan (VII-6-1903, "Rhus-like-shrub", C.H.T. Townsend), 2 slides, 2 specimens (USNM), location unknown (VII-1903, "Rhus-like-shrub", collector unknown), 4 slides, 4 specimens (USNM); Nuevo Leon, Sabinas Hidalgo (111-28-1957, *Citrus* sp., T. Tidmore), 1 slide, 3 specimens (USNM).

HOSTS AND DISTRIBUTION – *C. brachyurus* has not previously been recorded from the U.S. Although it was collected as early as 1944 in Alabama, it was identified as *Ceroplastes* sp. This species is probably native to Mexico and the southwestern U.S. The Alabama infestation was apparently an introduction. Outside of the U.S., it has been found only in Mexico.

Due to the limited amount of material available, it is difficult to indicate preferred hosts; however, since specimens have been collected from a species of *Bouvardia* in an apparently natural situation, we believe that *Bouvardia* may be one of the preferred hosts.

ECONOMIC IMPORTANCE – *C. brachyurus* is of dubius economic importance, although its occurrence on *Ilex* makes it suspect of possible future concern to ornamentalists.

BIOLOGY – The only available biological information known for *brachyurus* is that the adult females are normally found on the stems of their hosts.

DISCUSSION – *C. brachyurus* is characterized as follows: dorsal setae predominantly conical with nearly pointed apices; with 1 ventral seta on each anal plate; with unusually long marginal bristle-shaped setae about 34 μ long, with about 16 stigmatic setae laterad of each stigmatic furrow which are hemispherical to bullet-shaped with rounded or truncate apices; without filamentous ducts; multilocular pores present on abdominal segments 4-8; legs with tibiotarsal scleroses, with equal claw digitules; antennae normally 7-segmented.

According to Cockerell (1903), *brachyurus* resembles *albolineatus* Cockerell. We do not consider these species closely related. However, because only a single very poor specimen of authentic *albolineatus* was available for this study, it is difficult to draw definitive conclusions about their relationship. *C. albolineatus* does differ in possessing filamentous ducts which are absent from *brachyurus*.

In the U.S., *brachyurus* resembles *sinensis*. *C. sinensis* differs as follows: with 2 ventral setae on each anal plate; with from 18-43 stigmatic setae laterad of each stigmatic furrow, with the large seta in the outer row either bullet-shaped with rounded apices or lanceolate with the apical third bent; with a ventral submarginal band of filamentous ducts; multilocular pores present on abdominal segment 4. Whereas, *brachyurus* possesses: 1 ventral seta on each anal plate; from 13-22 stigmatic setae laterad of each stigmatic furrow, with the large

seta in the outer row bullet-shaped with truncate, bluntly rounded, or broadly pointed apices, the apical third never bent; no filamentous ducts; multilocular pores absent on abdominal segment 4.

Ceroplastes ceriferus (Fabricius)
Suggested Common Name: Indian Wax Scale
Figures 4(2), 6(2), 9, 10, 11

Coccus ceriferus Fabricius, 1798, p. 546.
Coccus chilensis Gray, 1828, p. 7.
Ceroplastes ceriferus (Fabricius); Walker, 1852, p. 1087.
Ceroplastes australiae Walker, 1852, p. 1087.
Columnea cerifera (Fabricius); Targioni-Tozzetti, 1866, p. 144.
Lacca alba Signoret, 1869, p. 848.
Gascardia cerifera (Anderson); De Lotto, 1965, p. 198.

The common name of this species is a problem. The following have been used in the past: Chinese wax scale (Froggatt 1908); Indian wax scale (Sankaran 1959); Indian white wax scale (Gurney 1936); Japanese wax scale (Williams and Kosztarab 1972); Mexican wax scale (Watson and Berger 1926); wax scale (Shriver, Gimpel, and Davidson 1970). The name most commonly used in the recent literature in the U. S. is Japanese wax scale (e.g., Dekle 1963, Smith *et al.* 1971), but it is our feeling that this name should more logically be applied to *Ceroplastes japonica* Green. Of the remaining names, Indian wax scale seems like the best choice since *ceriferus* was first collected in India and is probably native to that country.

TYPE DATA – The type locality is near Madras, on the southeastern coast of India. *Celastrus ceriferus* has been reported as the type host, but apparently no *Celastrus* species with this name has been described. According to De Lotto (1971) no type material is known to exist. Anderson was generally erroneously credited with the authorship of *ceriferus* until De Lotto (1971) corrected the error and gave an excellent historical account of the authorship, type host, and type locality.

FIELD CHARACTERS – The following description is based on fresh material.

Test: wet wax nearly round in dorsal view, hemispherical laterally, normally with anteriorly projecting horn, white to pinkish white, with conspicuous marginal flange which may hide lateral filaments, plates visible only on older adult females, without nuclei. Dry wax with filaments as follows: cephalic filament appearing trifurcate, with acute apices; anterolateral and mediolateral filaments simple; posterolateral filaments bifurcate; caudal filaments simple; dorsal dry wax of first and second instars forming cap at apex of horn, not surrounded by nucleus; dorsal dry wax tilted anteriorly. Stigmatic wax bands present near both pairs of spiracles, anterior bands directed dorsally, filamentous wax confined to stigmatic areas. Length 6.9 mm (3.0-12.0), width 6.3 mm (2.7-10.4), height 4.6 mm (2.0-8.2).

Body: elliptical, dark reddish brown; anal process in older adult females elongate.

SLIDE MOUNTED CHARACTERS – Adult female elliptical, length 5.6 mm (3.1-8.0), width 5.2 mm (2.4-7.4).

Dorsum: membranous in young adult females, sclerotized in older adult females; with 3 cephalic, 0 mediodorsal, and 8 lateral clear areas devoid of pores and setae, except medial cephalic area with 2 cylindrical setae, rarely cephalic and posterolateral areas partially divided leaving 2 cephalic areas and/or 6 or 7 posterolateral areas; dorsal setae variable (fig. 6(2)), about 200 cylindrical setae with pointed, blunt, or slightly expanded apices, 6.0 μ (4.3-9.0) long. Dorsal pores distributed as follows: about 20 bilocular pores more numerous toward submargin; about 420 oval trilocular pores evenly distributed, 1900 triangular trilocular pores, evenly distributed; about 80.0 quadrilocular pores mainly located in posteromesal area; about 5 quinquelocular pores mainly located around anal process. Tubular ducts absent. Anal plates each with 1 ventral and 4 dorsal setae.

Margin: marginal bristle-shaped setae 19.9 μ (13.1-25.1) long, evenly spaced except where replaced by stigmatic setae, placed as follows: 6.0 (5.0-7.0) between eye tubercles, 2.0 (1.0-5.0) between each eye tubercle and each anterior stigmatic furrow, 3.0 (2.0-4.0) between each anterior and posterior stigmatic furrow, 10.0 (8.0-12.0) between each posterior stigmatic furrow and anal cleft, last 3-5 thicker, longer, 36.8 μ (26.3-43.2), in cluster on anal lobes; stigmatic setae bullet-shaped to lanceolate with pointed apices (fig. 4(2)) length 1.5 to 2.0 times greater than width at base,

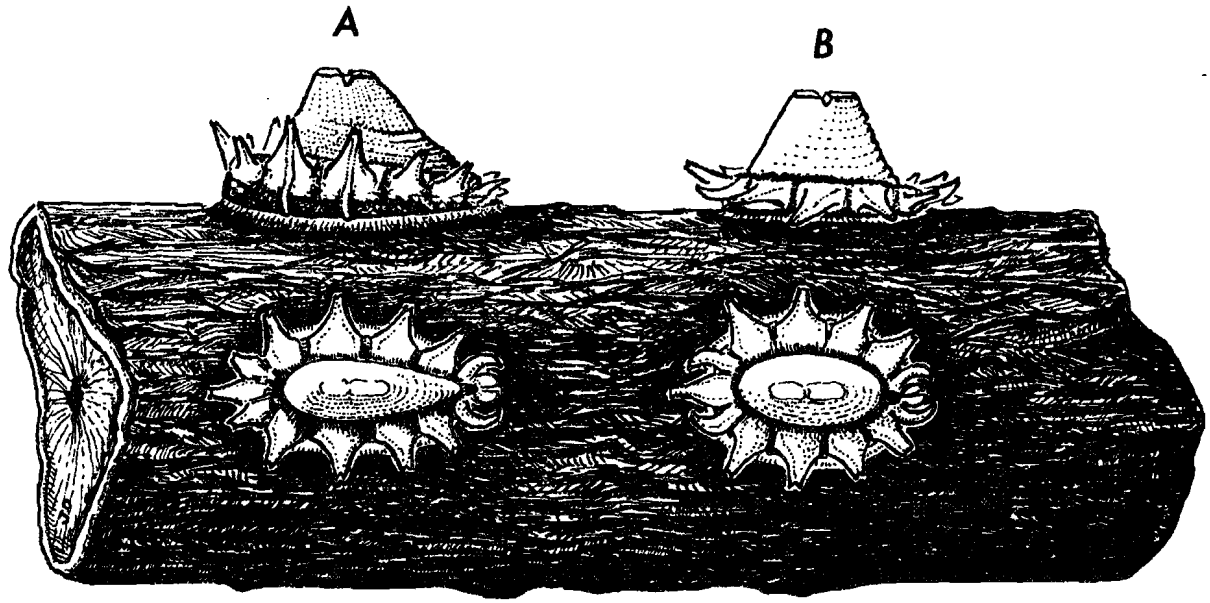


Figure 9. *Ceroplastes ceriferus.* Wax test second instar a. male b. female, Maryland, Prince Georges Co., College Park, University greenhouse (VI-5-1972, *Euonymus japonicus).*

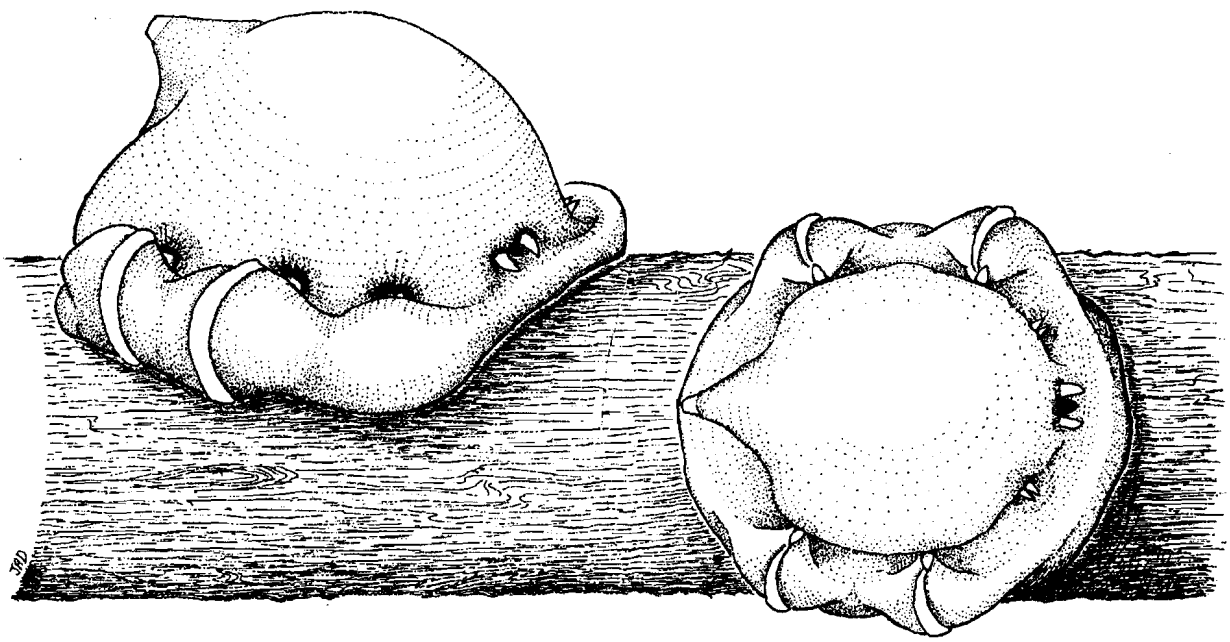


Figure 10. *Ceroplastes ceriferus.* Wax test adult female, Maryland, Prince Georges Co., College Park, University greenhouse (VI-10-1972, *Euonymus japonicus).*

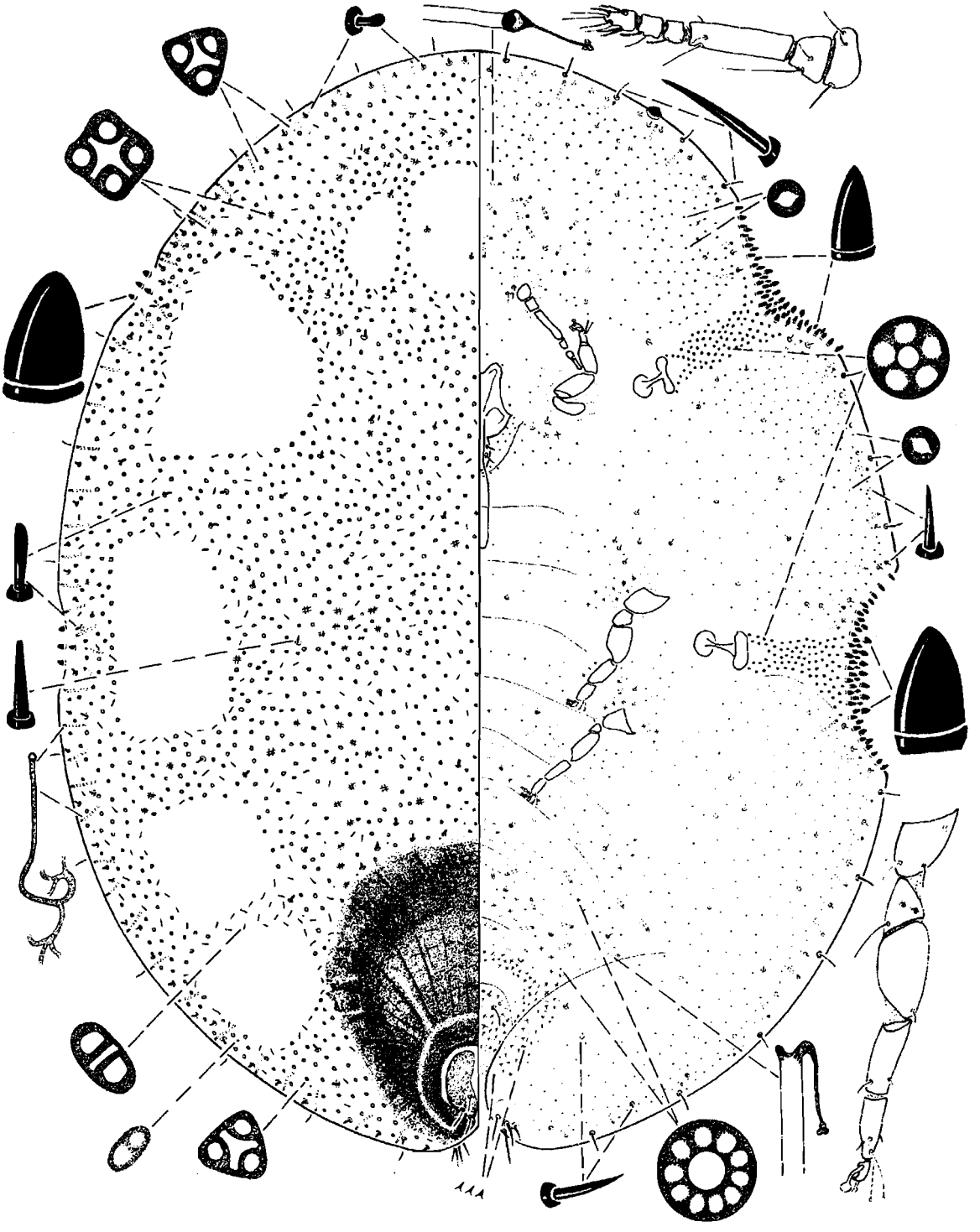


Figure 11. *Ceroplastes ceriferus.* Slide mounted adult female. South Carolina, Charleston Co., Bulls Island (VIII-11-1944, *Persea* sp.).

54.0 (28.0-88.0) laterad of each stigmatic furrow in triangular cluster formed by 6 irregular rows, length from 7.8-37.1 μ long. Filamentous ducts in 2 rows, 1 row between marginal bristle-shaped setae and submarginal setae, 1 row between marginal bristle-shaped setae and dorsal pores, with dermal orifice monocular. Eye tubercles slightly protruding.

Venter: membranous; bristle-shaped setae placed as follows: 45.0 (37.0-51.0) on each submargin, 8.7 μ (7.8-9.5) long, 4.0 (1.0-6.0) associated with each coxa, 10.0 (8.0-14.0) in cephalic region, 4.0 (1.0-12.0) on each abdominal and thoracic segment; interantennal space with 1 or 2 pairs of lateral bristle-shaped setae 13.1 μ (8.7-24.0) long; 1 pair of mesal bristle-shaped setae 43.5 μ (32.3-54.0) long; 1 pair of mesal bristle-shaped setae 47.5 μ (32.0-54.0) long on segment 8 anterior to vulva, surrounded by 2-4 pairs of short bristle-shaped setae 8.7 μ (7.8-11.1) long. About 1650 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous towards meson; 110.0 (80.0-160.0) stigmatic pores in irregular band in each stigmatic furrow extending from spiracular atrium to stigmatic setae, most furrows predominantly with quinquelocular pores; nearly always with several pores with more than 5 loculi; about 650 multilocular pores surround vulva, 40.0 (33.0-58.0) on seventh abdominal segment, 10 0 (6.0-32.0) on each preceding abdominal segment, 4.0 (0.0-9.0) near base of each coxa. Tubular ducts with slightly asymmetrical cups, each duct with inner filament nearly as long and much narrower than basal part of duct, arranged in 2 clusters as follows: 24.0 (16.0-46.0) in cephalic region; 22.0 (17.0-34.0) in region of vulva. Legs 261.0 μ (158.0-270.0) long; tibia without basal setae, tibia less than 2 times length of tarsus, without tibiotarsal scleroses; tarsal digitules 33.0 μ (32.0-36.8) long; with unequal claw digitules 29.0 μ (23.0-32.0) long; claws without denticles; length of leg segments as follows: coxa 33.8 μ (32.3-34.5), trochanter plus femur 108.0 μ (75.0-111.0), tibia 63.0 μ (48.0-65.3), tarsus 46.5 μ (43.5-48.0), claw 10.8 μ (9.5-11.3) long. Antennae 6-segmented, 180.0 μ (142.5-195.0) long.

SPECIMENS EXAMINED – **Alabama:** Lee Co., Auburn (I-25-1953, *Spiraea* sp., H. H. Tippins), 1 slide, 2 specimens (USNM), location unknown (IX-14-1970, *Pyracantha* sp., Barnett), 3 slides, 3 specimens (WG).

Arkansas: Union Co., El Dorado (IX-18-1958, *Camellia* sp., G. C. Dowell), 1 slide, 4 specimens (USNM).

Florida: Alachua Co., Gainesville (VII-1-1970, *Podocarpus nagi*, Makino), 3 slides, 3 specimens (WG), (VII-7-1970, *Podocarpus* sp., G.W. Dekle), 7 slides, 7 specimens (WG); Lake Co., Montverde (VII-22-1970, *Camellia* sp., G. W. Dekle), 4 slides, 4 specimens (WG), (*Podocarpus macrophyllus*, G. W. Dekle), 2 slides, 2 specimens (WG); Polk Co., Winter Haven (VII-13-1970, *Camellia japonica*, G. W. Dekle), 1 slide, 1 specimen (WG).

Georgia: Bryan Co., Richmond Hill (XII-7-1943, *Camellia japonica*, Mayer), 1 slide, 1 specimen (USNM), (XII-8-1943, *Crataegus* sp., Mallia), 1 slide, 1 specimen (USNM); Chatham Co., Savannah (XI-17-1936, *Camellia japonica*, V. C. Durham), 1 slide, 1 specimen (USNM); Clarke Co., Athens (1951, *Buxus sempervirens*, G. C. Hendrix), 1 slide, 1 specimen (USNM); Fulton Co., Atlanta (IV-21-1939, *Buxus* sp., J. R. Adams), 1 slide, 3 specimens (USNM), (XI-3-1939, *Buxus* sp., F. Gordon), 2 slides, 2 specimens (USNM), (X-15-1943, *Buxus* sp., J. H. Girardeau), 1 slide, 3 specimens (USNM), Atlanta-Brookhaven (IX-18-1947, *Spiraea* sp., Turner), 1 slide, 1 specimen (USNM); Glynn Co., Sea Island (X-13-1950, *Podocarpus* sp., M.J. Kiser), 1 slide, 1 specimen (USNM); Harris Co., Hamilton (XI-10-1941, *Vaccinium* sp., T. L. Bissell), 1 slide, 1 specimen (USNM); Oconee Co., Bishop (V-10-1954, *Buxus* sp. and *Ilex cornuta* 'Burfordii', H. O. Lund), 1 slide, 2 specimens (USNM); Tift Co., Tifton (XII-7-1944, *Vaccinium* sp., P. M. Gilmer), 1 slide, 1 specimen (USNM); Walton Co., location unknown (IV-7-1954, *Buxus* sp., J. R. Jordan), 1 slide, 2 specimens (USNM); Co., unknown, Ridgeland (XI-27-1943, *Lagerstroemia indica*, Carter), 1 slide, 1 specimen (USNM), location unknown (XII-6-1944, *Vaccinium* sp., F. F. Cowart), 1 slide, 1 specimen (USNM).

Illinois: Champaign Co., Urbana (III-1945, *Camellia* sp., M. Farrar), 2 slides, 5 specimens (USNM).

Maryland: Baltimore Co., Owings Mills (IX-13-1960, *Ilex* sp., C. W. McComb), 1 slide, 1 specimen (USNM); Frederick Co., Frederick (IX-22-1959, *Mahonia* sp., C. W. McComb), 1 slide, 1 specimen (USNM), location unknown (1958, *Camellia japonica*, E. E. Tullis), 1 slide, 5 specimens (USNM); Montgomery Co., Takoma Park (1970, *Ilex cornuta* 'Burfordii', J. A. Davidson), 4 slides, 8 specimens (UM); Prince Georges Co., Beltsville (greenhouse reared) (VIII-27-1969, *Ilex cornuta* 'Burfordii', W. F. Gimpel), 3 slides, 6 specimens (WG), (IX-3-1969, *Ilex japonicus*, W. F. Gimpel), 1 slide, 2 specimens (WG), (IX-3-1969, *Ilex cornuta* 'Burfordii', W. G. Gimpel), 1 slide 2 specimens (WG), (X-1-1969, *Ilex cornuta 'Burfordii'*, W. F. Gimpel), 2 slides, 5 specimens (WG), (II-4-1970, *Ilex cornuta* 'Burfordii', W. F. Gimpel), 3 slides, 3 specimens (WG), College Park (1970, host unknown T. L. Bissell), 2 slides, 2 specimens (UM), College Park (greenhouse reared) (IX-10-1969, *Euonymus japonicus*, W. F. Gimpel), 1 slide, 1 specimen (WG), (IX-17-1969, *Ilex cornuta* 'Burfordii', W. F. Gimpel), 4 slides, 10 specimens (WG), (VI-25-1970, *Euonymus japonicus*, W. F. Gimpel), 1 slide, 1 specimen (WG), (VI-1970, *Euonymus japonicus*, W. F. Gimpel), 1 slide, 1 specimen (WG), (VII-8-1970, *Euonymus japonicus*, W. F. Gimpel), 1 slide, 1 specimen (WG), (VIII-14-1970, *Euonymus japonicus*, M. B. Stoetzel), 1 slide, 3 specimens (WG), (VIII-17-1970, *Euonymus japonicus*, M. B. Stoetzel), 1 slide, 4 specimens (WG), (VIII-21-1970, *Ilex cornuta* 'Burfordii', M. B. Stoetzel), 2 slides, 4 specimens (WG), (VIII-24-1970, *Ilex cornuta* 'Burfordii', W. F. Gimpel), 2 slides, 4 specimens (WG), (VIII-25-1970, *Euonymus japonicus*, W. F. Gimpel), 1 slide, 3 specimens (WG), Hyattsville (VIII-5-1959, *Ilex* sp., C. W. McComb), 2 slides, 2 specimens (USNM), (III-1-1970, *Ilex*

cornuta 'Burfordii', W. F. Gimpel), 4 slides, 14 specimens (WG), (VIII-3-1970, *Pyracantha* sp., M. B. Stoetzel), 1 slide, 1 specimen (WG), (VIII-10-1970, *Ilex cornuta* 'Burfordii', M. B. Stoetzel), 1 slide, 1 specimen (WG), (*Pyracantha* sp., M. B. Stoetzel), 1 slide, 1 specimen (WG), (VIII-14-1970, *Pyracantha* sp., M. B. Stoetzel), 1 slide, 2 specimens (WG), (VIII-17-1970, *Pyracantha* sp., M. B. Stoetzel), 1 slide, 1 specimen (WG), (VIII-19-1970, *Pyracantha* sp., M. B. Stoetzel), 1 slide, 1 specimen (WG), (VIII-21-1970, *Pyracantha* sp., M. B. Stoetzel), 1 slide, 1 specimen (WG), (VIII-24-1970, *Pyracantha* sp., W. F. Gimpel), 2 slides, 2 specimens (WG), (*Ulmus* sp., W. F. Gimpel), 1 slide, 1 specimen (WG), (VIII-26-1970, *Pyracantha* sp., W. F. Gimpel), 3 slides, 5 specimens (WG), (IX-1-1970, *Ilex cornuta* 'Burfordii', W. F. Gimpel), 2 slides, 3 specimens, (WG), (*Pyracantha* sp., W. F. Gimpel), 2 slides, 2 specimens (WG), (*Ulmus* sp., W. F. Gimpel), 2 slides, 2 specimens (WG), (X-27-1970, *Ilex opaca*, W. F. Gimpel), 2 slides, 2 specimens (WG), (XII-15-1970, *Ilex opaca*, W. F. Gimpel), 7 slides, 7 specimens (WG), (I-12-1971, *Ilex opaca*, W. F. Gimpel), 8 slides, 11 specimens (WG), location unknown (X-19-1959, *Ilex* sp., and *Tsuga* sp., C. W. McComb), 1 slide, 3 specimens (USNM).

New Jersey: Atlantic Co., Northfield (XI-5-1962, *Euonymus* sp., W. M. Boyd), 1 slide, 1 specimen (USNM).

New York: Orleans Co., Medina (XI-8-1948, *Camellia* sp., W. E. Blauvelt), 1 slide, 5 specimens (USNM).

North Carolina: Chowan Co., location unknown (III-14-1956, *Ilex vomitoria*, M. H. Farrier), 1 slide, 3 specimens (USNM); Duplin Co., Faison (IX-14-1943, *Pittosporum* sp., C. S. Brimley), 2 slides, 7 specimens (USNM); Nash Co., location unknown (X-1-1956, *Ilex vomitoria*, M. H. Farrier), 1 slide, 3 specimens (USNM); Robeson Co., location unknown (I-11-1960, *Spiraea* sp., E. R. Brimley), 1 slide, 3 specimens (USNM); Co. and location unknown (IX-1953, host unknown, W. M. Kulash), 1 slide, 2 specimens (USNM).

South Carolina: Beaufort Co., Burton (XI-24-1944, *Persea* sp., Mallia), 1 slide, 1 specimen (USNM); (*Vaccinium arboreum*, Mallia), 1 slide, 1 specimen (USNM), Charleston Co., Bulls Island (VIII-11-1944, *Callicarpa* sp., Gordon), 1 slide, 1 specimen (USNM), (*Persea* sp., Mallia), 1 slide, 1 specimen (USNM), (*Ilex* sp., Mallia), 1 slide, 1 specimen (USNM), Charleston (XII-27-1943, *Magnolia* sp., Kisliuk), 1 slide, 1 specimen (USNM), Johns Island (XI-16-1944, *Azalea* sp., Mallia), 1 slide, 1 specimen (USNM), (*Camellia japonica*, Mallia), 1 slide, 1 specimen (USNM), (*Camellia* sp., G. Rau), 1 slide, 1 specimen (USNM), (*Persea* sp., Mallia), 1 slide, 1 specimen (USNM), (XII-8-1947, *Ilex vomitoria*, C. N. Hastie), 1 slide, 3 specimens (USNM); Jasper Co., Ridgeland (XI-3-1944, *Pyrus* sp., Atkins), 1 slide, 1 specimen (USNM); Co. and location unknown (X-5-1946, *Camellia japonica*, J. G. Brallie), 1 slide, 1 specimen (USNM).

Texas: Dallas Co., Irving (IX-23-1968, *Ilex* sp., G. M. Hess), 1 slide, 2 specimens (USNM).

Virginia: Chesterfield Co., location unknown (VII-16-1969, host unknown, D. K. Pollet, J. A. Weidhaas), 3 slides, 3 specimens (WG); James City Co., location unknown (II-26-1970, *Euonymus japonicus*, D. K. Pollet), 10 slides, 23 specimens (WG), (*Ilex crenata* 'Rotundifolia', D. K. Pollet), 5 slides, 9 specimens (WG): Norfolk Co., location unknown (IX-12-1969, *Ilex* sp., D. K. Pollet), 2 slides, 3 specimens (WG); Princess Anne Co., location unknown (VII-17-1969, *Ilex cornuta* 'Burfordii', J. A. Weidhaas), 2 slides, 2 specimens (WG); Independent cities: Charlottesville (V-12-1971, host unknown, collector unknown), 5 slides, 7 specimens (USNM), Colonial Heights (II-26-1970, *Ilex cornuta* 'Burfordii', J. J. May), 5 slides, 5 specimens (WG), Danville (VII-18-1969, *Ilex cornuta* 'Burfordii', J. J. May), 5 slides, 5 specimens (WG), Danville (VII-18-1969, *Ilex cornuta* 'Burfordii', D. K. Pollet, J. A. Weidhaas), 1 slide, 1 specimen (WG), (11-27-1970, *Euonymus* sp., D. K. Pollet), 2 slides, 4 specimens (WG), (*Ilex cornuta* 'Burfordii', D. K. Pollet), 5 slides, 9 specimens (WG), Franklin (II-27-1970, *Ilex cornuta* 'Burfordii', D. K. Pollet), 4 slides, 10 specimens (WG), Norfolk (IX-29-1941, *Gardenia* sp., F. R. Fruend), 2 slides, 5 specimens (USNM), (II-18-1946, *Ilex* sp., Anderson), 1 slide, 2 specimens (USNM), (I-16-1970. *Ilex cornuta* 'Burfordii', J. A. Weidhaas), 2 slides, 4 specimens (WG), (*Ilex crenata* 'Rotundifolia', J. A. Weidhaas), 8 slides, 8 specimens (WG), Portsmouth (IX-11-1969, *Pyracantha* sp., D. K. Pollet), 2 slides, 4 specimens (WG), (I-20-1970, *Ilex crenata* 'Rotundifolia', J. Daum), 4 slides, 7 specimens (WG), (III-19-1970, *Euonymus japonicus*, E. B. Drewry), 2 slides, 4 specimens (WG), (*Ilex vomitoria*, E. B. Drewry, J. M. Pierce), 2 slides, 4 specimens (WG), (*Pyracantha coccinea*, E. B. Drewry), 2 slides, 4 specimens (WG), Richmond (VII-16-1969, *Ilex crenata* 'Convexa', D. K. Pollet), 1 slide 1 specimen (WG), (*Tsuga canadensis*, D. K. Pollet, J. A. Weidhaas), 2 slides, 2 specimens (WG), (II-25-1970, *Buxus sempervirens* 'Suffruticosa', J. J. May), 3 slides, 4 specimens (WG), (*Camellia japonica*, D. P. Innes), 2 slides, 4 specimens (WG), (*Ilex cornuta* 'Burfordii', D. P. Innes) 5 slides, 19 specimens (WG), (*Ilex crenata*, 'Rotundifolia', D. P. Innes), 9 slides, 13 specimens (WG), (*Tsuga* sp., D. P. Innes), 1 slide, 1 specimen (WG), (III-10-1970, *Tsuga canadensis*, D. P. Innes), 3 slides, 11 specimens (WG), (X-30-1970, *Ilex cornuta* 'Burfordii', J. J. May), 9 slides, 9 specimens (WG), Virginia Beach (III-8-1954, *Euonymus europaeus*, E. N. Cory), 14 slides, 17 specimens (UM), (III-24-1971, *Tamarix gallica*, B. Pristou), 1 slide, 3 specimens (USNM), (II-25-1970, *Ilex cornuta* 'Burfordii', D. K. Pollet), 10 slides, 10 specimens (WG), (V-9-1971, *Vaccinium* sp., W. F. Gimpel), 3 slides, 3 specimens (WG).

Washington, D. C.: (XII-8-1954, *Ilex cornuta* 'Burfordii', F. Weiss), 1 slide, 6 specimens (USNM), (IX-1960, *Ilex aquifolium*, W. L. Saunders), 2 slides, 2 specimens (USNM), (III-1961, *Ilex cornuta* 'Burfordii' and *I. crenata* 'Rotundifolia', J. P. Secrest), 1 slide, 2 specimens (USNM), (I-1970, *Ilex* sp., R. E. Menzer), 77 slides, 77 specimens (WG), (VIII-17-1970, *Ilex* sp., R. Bellinger), 2 slides, 7 specimens (WG), (XII-15-1970, *Ilex serrata*, W. F. Gimpel), 6 slides, 6 specimens (WG), (XII-16-1970, *Ilex latifolia*, W. F. Gimpel), 1 slide, 1 specimen (WG), (*Ilex serrata*, W. F. Gimpel), 2 slides, 2 specimens (WG).

FOREIGN SPECIMENS EXAMINED – Australia: New South Wales, Sydney (V-8-1968, *"Monocota alliptica"*, D. P. Sands), 1 slide, 1 specimen (UCD); State unknown, location unknown (date unknown, host unknown, A. Kocbele), 3 slides, 3 specimens (USNM).

Fiji: Wangaval, Lav (VIII-27-1924, host unknown Bryan), 1 slide, 1 specimen (USNM).

India: Madhya Pradesh, Raipur (VIII-1911, host unknown, R. S. Woglum), 1 slide, 1 specimen (USNM); Uttarpradesh, Dehra Dun (date unknown, host unknown, R. S. Woglum), 1 slide, 1 specimen (USNM); West Bengal, Calcutta (XII-1910,

Ficus *"rugosa"*, R. S. Woglum), 1 slide, 1 specimen (USNM); State unknown, location unknown (date unknown, host unknown, collector unknown), 1 slide, 2 specimens (USNM).

Indonesia: Java, Bogor (XI-1953, *Nephelium lappaceum*, Tjoa Tjien Mo), 1 slide, 1 specimen (USNM); Sumatra, Buo (II-1914, host unknown, E. Jacobson), 1 slide, 2 specimens (USNM).

Japan: Honshu, Nishigahara (IV-12-1901, *Camellia* sp., C. L. Marlatt), 2 slides, 2 specimens (USNM), (date unknown, *Camellia* sp., S. I. Kuwana), 1 slide, 1 specimen (UCD), Okayama (V-5-1901, *Camellia* sp., C. L. Marlatt), 2 slides, 2 specimens (USNM), Tachikawa (IX-9-1966, *Camellia sinensis*, S. Kawai), 1 slide, 10 specimens (WG), (IX-16-1966, *Cucurbita moschata*, S. Kawai), 1 slide 12 specimens (WG), (X-29-1966, *Cucurbita moschata*, S. Kawai), 1 slide, 7 specimens (WG), (XI-9-1966, *Cucurbita moschata*, S. Kawai), 1 slide, 6 specimens (WG); Shikoku, Takamatsu (VI-4-1901, *Prunus* sp., C. L. Marlatt), 1 slide, 1 specimen (USNM); Island and location unknown (III-4-1927, host unknown, E. I. Smith, at Seattle), 1 slide, 1 specimen (USNM), (III-28-1927, host unknown, M. J. Forsell, at Seattle), 1 slide, 1 specimen (USNM), (IV-17-1932, *Citrus* sp., W. J. Ehinger, at Philadelphia), 1 slide, 1 specimen (USNM), (V-23-1933 *Fatsia japonica*, J. C. Pritchett, at New Orleans), 1 slide, 1 specimen (USNM), (XII-25-1935, *Camellia* sp., C. U. Scott, at Seattle), 1 slide, 1 specimen (USNM).

Panama: Panama City (X-1-1918, *Thevetia nereifolia*, H. F. Dietz), 1 slide, 1 specimen (USNM).

Puerto Rico: Naguabo (III-9-1914, *"Sauvagesia erecta"*, T. H. Jones), 2 slide, 2 specimens (USNM).

Virgin Islands: St. Thomas, Louisenhoj Est. (III-26-1941, *Amaranthus* sp., Kisliuk), 1 slide, 3 specimens (USNM).

HOSTS AND DISTRIBUTION – Based on our records, *ceriferus* was first collected in the U. S. in Georgia in 1936. Although it is difficult to state when before 1936 that it was originally introduced, it is likely that the first introduction occurred somewhere in the southern U.S. This species is probably native to Asia since early records are from India and other Asian areas. It is now widely distributed and is considered nearly cosmopolitan. Collections from Arkansas, Illinois, New Jersey, and New York are probably introductions on nursery stock.

Kuwana (1923) lists 9 families of hosts from Japan and De Lotto (1971) lists 5 host families from Australia. In the U. S. the host list is extensive with holly as one of the preferred hosts.

Carnes (1907) reported this species as occurrring in a nursery in California, but we have not examined any of the resultant slide mounts.

ECONOMIC IMPORTANCE – *C. ceriferus* is an economic pest of many ornamental plants throughout its distribution in the U. S. It secretes large quantities of honeydew which provides a medium for sooty-mold fungi and gives an unsightly appearance to the foliage. The honeydew and sooty-mold fungus may build up in thick layers and reduce the amounts of photosynthesis. Heavy infestations of *ceriferus* may cause leaf drop and a reduction in plant vigor which may result in a leggy plant with only terminal leaves in small rosettes. On several species and varieties of *Ilex* this wax scale has been a particular nuisance. In some instances it has caused severe leaf drop and die back of branches.

BIOLOGY – Only biological characteristics of apparent taxonomic importance are given here; a more detailed biological treatment will be presented in a future paper. All instars of *ceriferus* are normally found on the stems or branches of their hosts and do not migrate from 1 area of the host to another. In heavy infestations individual wax tests tend to fuse together, completely surrounding infested branches. Males have been reported in Japan by Kuwana (1923) and in the U.S. by Smith, *et al.* (1971). During this study we have found small numbers (less than 2%) of males on greenhouse infestations maintained at the University of Maryland.

DISCUSSION – *C. ceriferus* is characterized as follows: Without a mediodorsal clear area and with cephalic and posterolateral clear areas divided; dorsal setae predominantly cylindrical with rounded apices; with 1 ventral seta on each anal plate; with about 54 stigmatic setae laterad of each stigmatic furrow which are bullet-shaped to lanceolate, with pointed apices; with 1 dorsal and 1 ventral submarginal band of filamentous ducts; multilocular pores present on all abdominal segments and normally present near each coxa; with appedages unusually short, legs about 261 μ long and antennae about 180 μ long, legs without tibiotarsal scleroses, with unequal claw digitules; antennae 6-segmented.

Of the foreign species examined, *pseudoceriferus* Green most nearly resembles *ceriferus*. *C. pseudoceriferus* has commonly been confused with *ceriferus*, e.g., in the excellent paper by Kawai and Tamaki (1967) on the morphology of *"pseudoceriferus"*, the species treated was actually *ceriferus*. This confusion is understandable since the characters previously used to separate these species were not constant in all specimens. Not until De Lotto (1971) used the length of the trochanter plus the femur, were workers able to distinguish these species in all instances. *C. pseudoceriferus* differs as follows: with about 40 marginal bristle-shaped setae between the anterior stigmatic furrows and with about 10 such setae between each anterior and posterior stigmatic furrow; with about 130 stigmatic setae laterad of each stigmatic

furrow; legs each about 535 μ long; antennae each about 400 μ long. Whereas, *ceriferus* possesses: about 10 marginal bristle-shaped setae between the anterior stigmatic furrows and about 3 such setae between each anterior and posterior stigmatic furrow; about 54 stigmatic setae laterad of each stigmatic furrow; legs each about 335 μ long; antennae each about 240 μ long. Another species, *albolineatus*, also resembles *ceriferus* in possessing what appears to be a dorsal and ventral row of filamentous ducts. But, because only a single very poor specimen of authentic *albolineatus* has been available for this study, it is difficult to draw definitive conclusions about its relationship to other species of *Ceroplastes*. However, it has been possible to distinguish *albolineatus* and *ceriferus*. *C. albolineatus* possesses: 7-segmented antennae; tibiotarsal scleroses; equal claw digitules. *C. ceriferus* possesses: 6-segmented antennae; no tibiotarsal scleroses; unequal claw digitules.

In the U. S. *ceriferus* is readily separable from all other species of *Ceroplastes* in possessing: 2 submarginal rows of filamentous ducts; no mediodorsal clear area; divided cephalic and posterolateral clear areas.

Ceroplastes cirripediformis Comstock
ESA Approved Name: Barnacle Scale
Figures 4(3), 6(3), 12, 13, 14.

Ceroplastes cirripediformis Comstock, 1881, p. 333.
Ceroplastes euphorbiae Cockerell, 1896a, p. 17 [New synonymy].
Ceroplastes mexicanus Cockerell, 1896b, p. 20 [New synonymy].
Ceroplastes plumbaginis Cockerell, 1893b, p. 82 [New synonymy].

TYPE DATA. – Comstock does not give an actual type locality in his original description, but states that *cirripediformis* was found in Jacksonville and in Volusia County. One of the 2 "types" in the Comstock Collection was collected in Sanford, Florida, which is in Seminole County just across the Volusia County line. It is likely that Comstock thought he was in Volusia County when he collected *cirripediformis* in Sanford. The type hosts are given as orange, quince, and a species of *Eupatorium*. Data labels previously attached to the pins holding the 2 dry "types" contained the following information: specimen number 1, "C. cirripediformis Coms. Type Eupatorium sp No. 391. Ceroplastes. Sanford Fla. Feb. 6/80"; specimen number 2, "C. cirripediformis Coms. Type No. 391. Ceroplastes sp. on Myrtle orange." These labels are now attached to the slides which contain these mounted specimens. Comstock did not designate a holotype specimen in his original description of this species. We here designate as lectotype (1 adult female on 1 slide) "type" number 1. The labels on this slide contain the following information: right label, "# 1 Lectotype *Ceroplastes cirripediformis* Comst. 1881 DET. W. F. GIMPEL" left label, "Florida Sanford II-6-1880 Ex. Eupatorium sp. col. J. H. Comstock # 391 USNM DET. W. F. GIMPEL mounted IX-1971." We also designate as paralectotype (1 adult female on 1 slide) "type" number 2. The labels on this slide contain the following information: right label, "# 2 Paralectotype *Ceroplastes cirripediformis* Comst. 1881 DET. W. F. GIMPEL" left label, "Florida # 391 of USNM date 1880 Ex. Myrtle orange col. J. H. Comstock DET. W. F. GIMPEL mounted Sept. 1971". The lectotype and the paralectotype are deposited in the USNM.

We have examined syntype material of *euphorbiae*, *mexicanus*. and *plumbaginis* and consider these species to be junior synonyms of *cirripediformis*.

FIELD CHARACTERS – The following description is based on fresh material.

Test: wet wax rectangular to oval in dorsal view, hemispherical laterally, without horn, dirty to grayish white, with marginal flange small or absent not hiding lateral filaments, divided into 1 dorsal and 6 lateral plates, with nuclei. Dry wax with filaments as follows: cephalic filament appearing trifurcate, with acute apices; anterolateral and posterolateral filaments simple; posterolateral filaments bifurcate; caudal filaments with weakly divided, bifurcate apices; dorsal dry wax of first and second instars forming small central cap, surrounded by large dorsomedial nucleus; dorsal dry wax not tilted. Stigmatic wax bands present near both pairs of spiracles, anterior bands directed dorsally, filamentous wax confined to stigmatic areas. Length 3.8 mm (1.0-7.1), width 2.4 mm (0.8-5.2), height 2.0 mm (0.7-4.2).

Body: oval, convex, dark reddish brown; anal process short.

SLIDE MOUNTED CHARACTERS – Adult female elliptical, length 3.5 mm (0.8-6.5), width 2.3 mm (0.5-5.0).

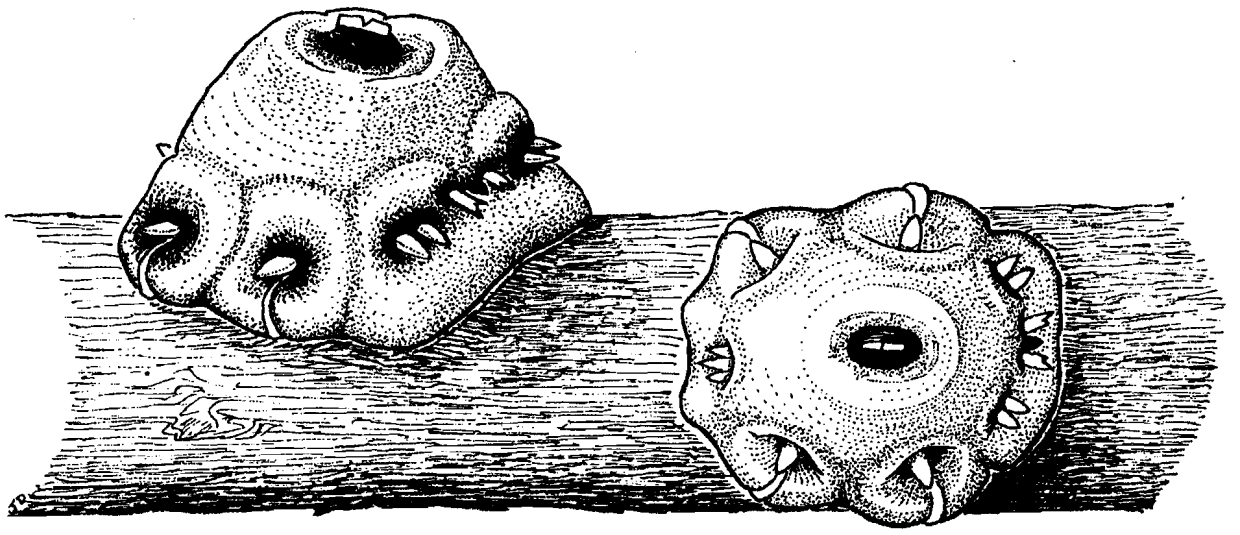


Figure 12. *Ceroplastes cirripediformis.* Wax test adult female. Maryland, Prince Georges Co., College Park, University greenhouse (VI-15-1972, *Gardenia jasminoides).*

Dorsum: membranous in young adult females, slightly sclerotized in older adult females; with 1 cephalic, 1 mediodorsal, and 6 lateral clear areas devoid of pores and setae, except cephalic area with 1 or 2 cylindrical setae; dorsal setae, variable (fig. 6(3)), about 36.0 cylindrical setae with pointed or blunt apices, 10.8 μ (7.8-11.3) long and about 45.0 capitate setae (plate 2d), 5.2 μ (3.5-9.5) long. Dorsal pores distributed as follows: about 200 bilocular pores evenly distributed; triangular trilocular pores variable 140 (5-300), evenly distributed; about 14.0 quadrilocular pores mainly located in posteromesal area; quinquelocular pores absent. Tubular ducts absent. Anal plates each with 1 ventral and 3 or 4 dorsal setae.

Margin: marginal bristle-shaped setae 23.6 μ (13.0-32.2) long, placed as follows: 6.0 (5.0-7.0) between eye tubercles, 2.0 (1.0-5.0) between each eye tubercle and each anterior stigmatic furrow, 3.0 (2.0-6.0) between each anterior and posterior stigmatic furrow, 10.0 (9.0-15.0) between each posterior stigmatic furrow and anal cleft, last 3-6 longer, 26.1 μ (19.6-55.0) in cluster on anal lobes; stigmatic setae mainly isosceles, occasionally cylindrical with apical third tapering, with pointed or slightly rounded apices (fig. 4(3)), length 1.5-2.5 times greater than width at base, 30.0 (17.0-55.0) laterad of each stigmatic furrow in 3 or 4 irregular rows, length from 8.1-21.0 μ long. Filamentous ducts absent. Eye tubercles slightly protruding.

Venter: membranous; bristle-shaped setae placed as follows: 35.0 (25.0-39.0) on each submargin, 8.7 μ (5.1-15.3) long, 1.0 (1.0-3.0) associated with each coxa, 3.0 (2.0-7.0) in cephalic region, 8.0 (3.0-12.0) on each abdominal and thoracic segment; interantennal space with 1 or 2 pairs of lateral bristle-shaped setae 17.4 μ (11.3-24.0) long, 1 pair of mesal bristle-shaped setae 45.3 μ (37.4-61.8) long; 1 pair of mesal bristle-shaped setae 58.0 μ (55.8-67.5) long on segment 8 anterior to vulva surrounded by 2-4 pairs of short bristle-shaped setae 8.7 μ (5.2-15.2) long. About 700 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous toward meson; 47.0 (33.0-85.0) stigmatic pores in band in each stigmatic furrow, extending from spiracular atrium to stigmatic setae, most furrows solely with quinquelocular pores, rarely with several pores with more than 5 loculi; about 200 multilocular pores surround vulva, 90.0 (75.0-135.0) on seventh abdominal segment, 12.0 (4.0-24.0) on each preceding abdominal segment, 2.0 (0.0-3.0) near base of each coxa. Tubular ducts with

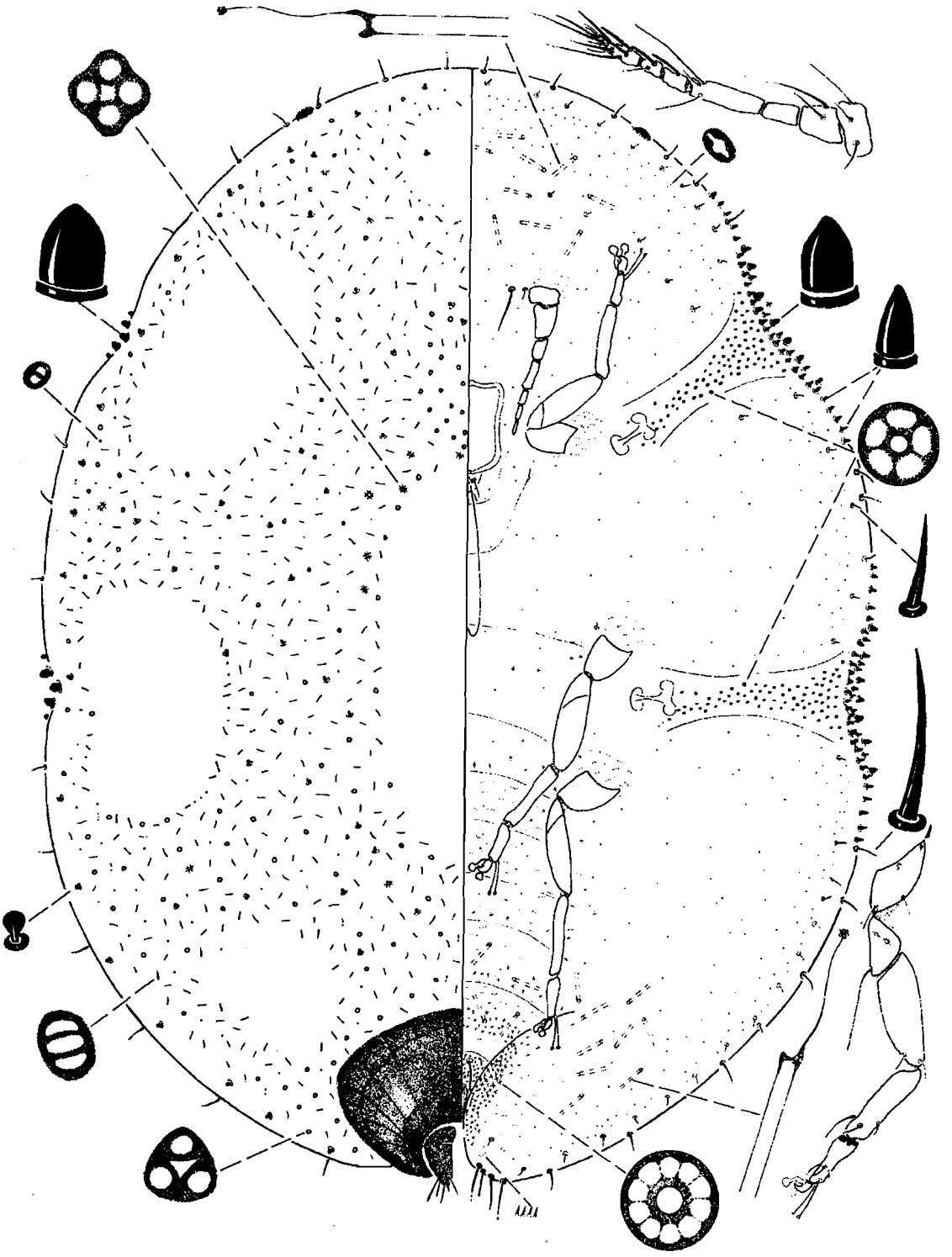


Figure 13. *Ceroplastes cirripediformis.* Slide mounted adult female. Jamaica (X-28-1894, *Euphorbia "hyperici"*) (also see fig 14).

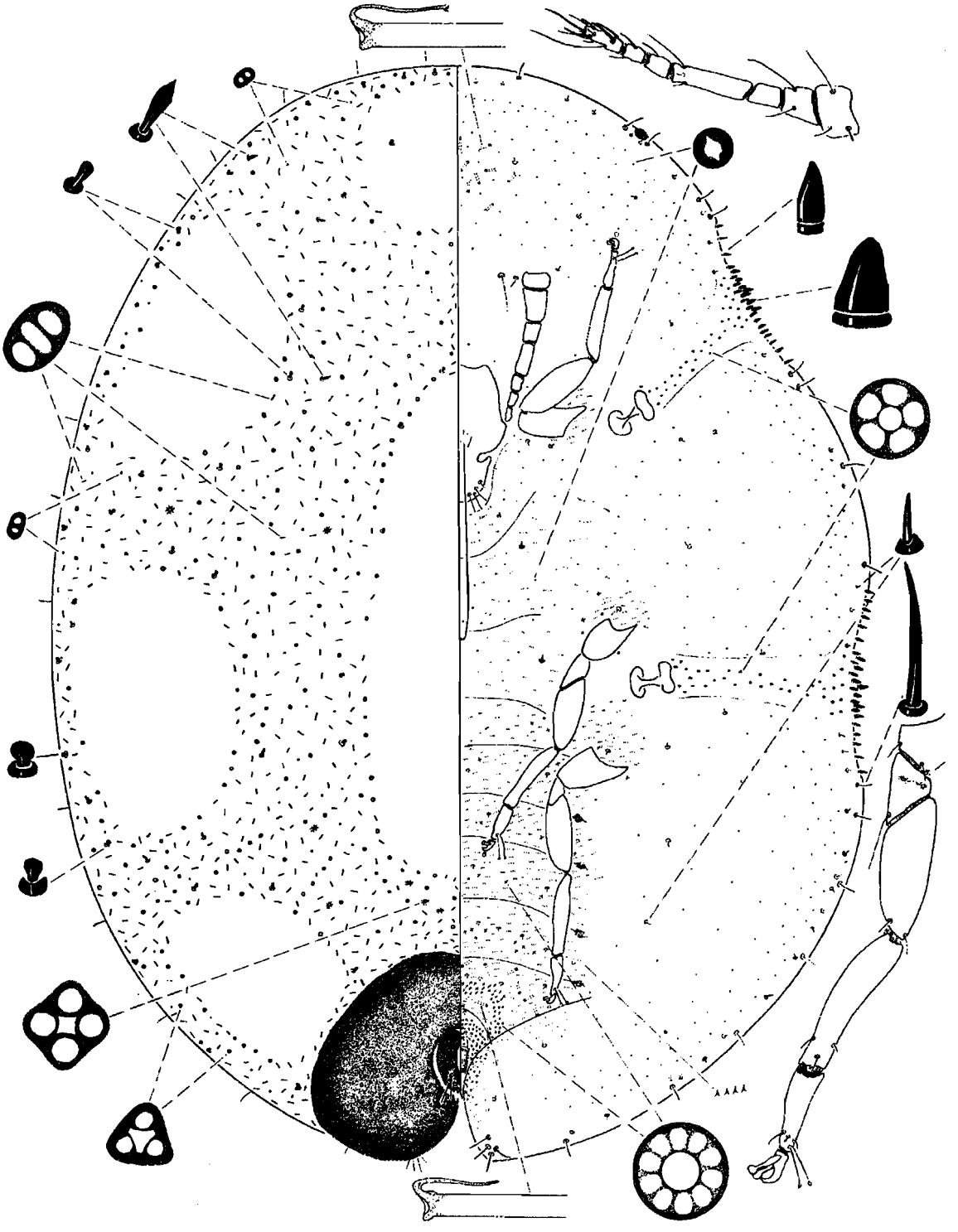


Figure 14. *Ceroplastes cirripediformis.* Slide mounted adult female. California, Los Angeles Co., La Puente (IX-19-1960, *Citrus* sp.) (also see fig. 13).

slightly asymmetrical cups, each duct with inner filament nearly as long and much narrower than basal part of duct, arranged in 2 clusters as follows: 16.0 (12.0-25.0) in cephalic region; 18.0 (16.0-31.0) in region of vulva. Legs 410.0 μ (342.0-555.0) long; tibia without basal setae, tibia less than 2 times length of tarsus, with tibiotarsal scleroses; tarsal digitules 48.5 μ (37.0-54.6) long; with equal claw digitules 28.7 μ (24.0-32.8) long; claws without denticles; length of leg segments as follows: coxa 69.8 μ (43.5-75.8), trochanter plus femur 140.0 μ (96.0-169.5), tibia 105.7 μ (87.0-126.0), tarsus 65.4 μ (54.5-72.0), claw 17.5 μ (17.4-21.8) long. Antennae 7-segmented, occasionally 6-segmented, 236.2 μ (205.0-283.5) long.

SPECIMENS EXAMINED – **Alabama:** Mobile Co., Mobile (VIII-12-1918, host unknown, H. Morrison), 1 slide, 2 specimens (USNM); Montgomery Co., Montgomery (III-26-1947, *Gardenia* sp., H. R. Dodge), 1 slide, 3 specimens (USNM); Co. unknown, location unknown (date unknown, *Melia* sp., Latimer), 4 slides, 4 specimens (USNM).

Arizona: Santa Cruz Co., Nogales (II-6-1941, *Cotoneaster* sp., Sudduth), 2 slides, 5 specimens (USNM), (XII-13-1954, *Myrtus* sp., collector unknown), 1 slide, 2 specimens (USNM).

California: Los Angeles Co., Baldwin Park (1-7-1935, *Passiflora* sp., F. R. Platt), 1 slide, 3 specimens (USNM), La Puente (IX-19-1960, *Citrus* sp., L. Johnson), 2 slides, 8 specimens (USNM), Pasadena (I-25-1965, *Cleyera japonica*, J. A. Munro), 1 slide, 3 specimens (USNM), Whittier (VIII-29-1935, *Passiflora* sp., collector unknown), 3 slides, 5 specimens (USNM), (VII-30-1935, *Citrus sinensis* 'Valencia', collector unknown), 3 slides, 4 specimens (USNM); San Diego Co., Escondido (date unknown, host unknown, J. Brunton), 2 slides, 2 specimens (USNM); San Mateo Co., Palo Alto (VII-22-1966, *Maytenus* sp., C. M. Sill), 1 slide, 1 specimen (USNM); Santa Clara Co., San Jose (VI-2-1969, *Ilex aquifolium*, J. Castro, A. Gilbert), 1 slide, 1 specimen (USNM).

Florida: Alachua Co., Gainesville (VII-1-1970, *Feijoa sellowiana*, G. W. Dekle), 12 slides, 12 specimens (WG); Baker Co., Macclenny (XII-5-1921, *Ipomoea batatas*, B. L. Boyden), 1 slide, 1 specimen (USNM); Hernando Co., Brooksville (II-3-1919, *Passiflora ligularis*, A. C. Mason), 1 slide, 1 specimen (USNM), (II-7-1920, *Passiflora edulis*, collector unknown), 1 slide, 1 specimen (USNM), (II-21-1921, *Dodonaea viscosa*, W. B. Wood), 1 slide, 2 specimens (USNM), (II-13-1922, *Ipomoea* sp., H. L. Sanford), 1 slide, 1 specimen (USNM); Highlands Co., Lake Placid (XII-24-1960, *Palafoxia feayi*, F. C. Craighead), 1 slide, 4 specimens (USNM); Hillsborough Co., Tampa (V-27-1944, *Ipomoea* sp., Griswold), 1 slide, 1 specimen (USNM), (*Rhizophora mangle*, Griswold), 1 slide, 1 specimen (USNM), location unknown (VI-2-1944, *Gaura "angustifolia"*, Tuthill), 2 slides, 2 specimens (USNM); Indian River Co., Vero Beach (IX-14-1971, *"Perkinsonia aculata"*, R. H. Hendrich), 4 slides, 10 specimens (USNM); Monroe Co., Key West (VI-15-1925, host unknown, W. H. Johnson), 1 slide, 2 specimens (USNM); Saint Lucie Co., Fort Pierce (XII-8-1943, *Strobilanthes anisophyllus*, Link, Tuthill), 2 slides, 3 specimens (USNM); Seminole Co., Sanford (II-6-1880, *Eupatorium* sp., J. H. Comstock), 1 slide, 1 specimen (USNM); Co. unknown, location unknown (1880, "myrtle orange", J. H. Comstock), 1 slide, 1 specimen (USNM), Chapman Field (I-16-21-1929, *Balanites "aegyptiaca"*, Chapman Davidson), 1 slide, 1 specimen (USNM).

Georgia: Bibb Co., Macon (II-4-1947, host unknown, D. H. Truman), 1 slide, 3 specimens (USNM); Chatham Co., Savannah (X-13-1919, *Ageratum* sp., E. E. Staton), 1 slide, 2 specimens (USNM); Dougherty Co., Albany (I-25-1929, *Celtis* sp., J. B. Gill), 2 slides, 7 specimens (USNM); Muscogee Co., Columbus (VII-22-1922, *Celtis laevigata*, H. E. Crawford), 1 slide, 3 specimens (USNM); Peach Co., Fort Valley (VIII-29-1922, *Celtis laevigata*, O. I. Snapp), 1 slide, 5 specimens (USNM); Thomas Co., Thomasville (I-24-1917, *Tamarix* sp., W. F. Turner), 1 slide, 1 specimen (USNM), (X-30-1941, *Myrtus* sp., E. Adams), 2 slides, 6 specimens (USNM).

Hawaii: Hawaii, Hilo (XI-29-1964, *Alternanthera amoena*, N. Neff), 1 slide, 1 specimen (USNM); Oahu, Honolulu (XII-1952, *Passiflora* sp., M. Sherman), 1 slide, 1 specimen (USNM), (IX-1-1958, *Amaranthus* sp., K. L. Maehler), 1 slide, 4 specimens (USNM), location unknown (XI-16-1954, *Schinus terebinthifolia*, L. M. Chilson, J. Fine), 1 slide, 3 specimens (USNM), (X-14-1956, *Philodendron* sp., J. H. Gayden), 1 slide, 1 specimen (USNM), (IX-25-1958, *Alternanthera amoena*, J. H. Gayden), 1 slide, 6 specimens (USNM); island unknown, location unknown (IV-22-1953, *Passiflora edulis*, K. L. Maehler), 1 slide, 2 specimens (USNM).

Louisiana: Avoyelles Parish, Mansura (III-3-1917, *Melia azedarach*, E. W. Nelson), 1 slide, 1 specimen (USNM), (III-3-1917) *Melia azedarach*, A. A. Rabalais), 2 slides, 2 specimens (USNM); East Baton Rouge Parish, Baton Rouge (1907, host unknown, W. Newell), 5 slides, 6 specimens (USNM), (IX-8-1913, *Chrysanthemum* sp., E. S. Tucker), 3 slides, 5 specimens (USNM), (XII-4-1913, *Chrysanthemum* sp., E. S. Tucker), 2 slides, 3 specimens (USNM), (VI-13-1914, "mistletoe", E. S. Tucker), 2 slides, 3 specimens (USNM), (VI-26-1929, *Parkinsonia* sp., W. E. Hinds), 1 slide, 1 specimen (USNM), (V-16-1952, *Gardenia* sp., E. A. Cancienne), 1 slide, 2 specimens (USNM); Plaquemine Parish, St. Claire (VIII-22-1913, *Citrus* sp., J. R. Horton), 1 slide, 1 specimen (USNM); Jefferson Parish, Metairie (II-23-1945, *Celtis laevigata*, Hein), 2 slides, 2 specimens (USNM); Lafayette Parish, Lafayette (XI-9-1916, host unknown, W. M. Ellison), 2 slides, 2 specimens (USNM), (XI-22-1943, *Ipomoea batatas*, Sorrell), 1 slide, 2 specimens (USNM); Orleans Parish, New Orleans (XI-22-1903, *Celtis* sp., L. O. Howard), 2 slides, 3 specimens (USNM), (X-31-1919, host unknown, W. W. Battaile), 2 slides, 4 specimens (USNM), (VIII-15-1924, *Citrus* sp., H. K. Plank), 1 slide, 1 specimen (USNM), (I-26-1934, *Salix* sp., J. H. Moreland), 1 slide, 1 specimen (USNM), (II-4-1944, *Celtis laevigata*, Gordon), 2 slides, 2 specimens (USNM); Parish unknown, Corenero (VIII-26-1926, *Diospyros* sp., H. Spencer), 1 slide, 2 specimens (USNM), McDonoghville (IV-23-1913, *Diospyros* sp., J. R. Horton), 2 slides, 3 specimens (USNM), Poindala Maiche (XI-2-1885, *Eupatorium "conchinum"*, collector unknown), 1 slide, 1 specimen (USNM).

Maryland: Harford Co., Bel Air (VI-8-1971, *Gardenia jasminoides* 'Radicans', C. W. McComb), 4 slides, 4 specimens (WG).

Mississippi: Pearl River Co., Picayune (VII-22-1929 *Citrus* sp., C. J. Coppock), 1 slide, 2 specimens (USNM).

North Carolina: New Hanover Co., Wilmington (I-31-1910, *Diospyros kaki*, Z. P. Metcalf), 1 slide, 1 specimen (USNM), (I-12-1932, host unknown, R. W. Leiby), 2 slides, 2 specimens (USNM); Wake Co., Raleigh (III-1957, *Camellia* sp., M. H. Farrier), 1 slide, 7 specimens (USNM).

Ohio: Franklin Co., Columbus (II-2-1945, *"Chouzema ilicifolia"*, T. H. Parks), 1 slide, 1 specimen (USNM); Hamilton Co., Cincinnati (II-12-1934, *Passiflora* sp., collector unknown), 1 slide, 3 specimens (USNM).

Pennsylvania: Montgomery Co., Lafayette (XI-8-1921, host unknown, G. W. Aurakian), 1 slide, 1 specimen (USNM); Philadelphia Co., Philadelphia (IV-19-1929, *Punica granatum*, R. G. Schneider), 1 slide, 3 specimens (USNM).

South Carolina: Beaufort Co., Beaufort (XII-12-1903, *Gardenia jasminoides*, collector unknown), 1 slide, 1 specimen (USNM); Charleston Co., Charleston (XI-20-1902, *Celtis* sp., collector unknown), 3 slides, 5 specimens (USNM), (III-31-1904, *Myrtus* sp., W. H. Parker, Jr.), 2 slides, 4 specimens (USNM), (VII-10-1923, *Tamarix* sp., E. R. Sasscer), 3 slides, 3 specimens (USNM), (VIII-2-1923, *Iva frutescens*, J. T. Rogers), 1 slide, 1 specimen (USNM), (VIII-2-1923, *Borrichia frutescens*, J. T. Rogers), 2 slides, 2 specimens (USNM), (X-24-1923, *Baccharis halimifolia*, J. T. Rogers), 1 slide, 1 specimen (USNM), (X-24-1923, *Iva frutescens*, J. T. Rogers), 1 slide, 1 specimen (USNM), (X-29-1923, *Ulmus* sp., J. T. Rogers), 1 slide, 1 specimen (USNM), (X-29-1943, *Celtis laevigata*, Mayer), 1 slide, 2 specimens (USNM), (XI-6-1944, *Ulmus pumila*, G. Rau), 1 slide, 1 specimen (USNM), (XI-7-1944, *Salix* sp., Mallia), 1 slide, 1 specimen (USNM), (XI-8-1944, *Cassia corymbosa*, Mallia), 1 slide, 1 specimen (USNM), (XI-10-1944, *Punica granatum*, Mallia), 1 slide, 1 specimen (USNM).

Texas: Brazoria Co., Alvin (X-24-1941, host unknown, R. K. Fletcher), 1 slide, 1 specimen (USNM); Brazos Co., College Station (IX-25-1946, *Ehretia anacua*, F. L. Thomas), 1 slide, 4 specimens (USNM); Hidalgo Co., Weslaco (II-10-1955, *Citrus limon*, H. A. Dean), 1 slide, 4 specimens (USNM); Jackson Co., Edna (VII-1-1908, *Citrus* sp., C. E. Sanborn), 1 slide, 1 specimen (USNM); Jefferson Co., Port Arthur (X-10-1917, *Punica granatum*, M. H. James, Jr.), 1 slide, 2 specimens (USNM), (IX-5-1941, *Gardenia* sp., W. H. Baskin), 1 slide, 2 specimens (USNM), (II-26-1943, *Gardenia* sp., W. H. Baskin), 1 slide, 1 specimen (USNM), Kleberg Co., Kingsville (VIII-17-1946, *"Anagua"*, F. L. Thomas), 1 slide, 1 specimen (USNM); Presidio Co., Presidio (XII-2-1943, *Artemisia* sp., J. H. Russell), 1 slide, 1 specimen (USNM).

Washington, D. C.: (I-4-1900, *Euphorbia pulcherrima*, collector unknown), 2 slides, 2 specimens (USNM), (XI-21-1917, *Psidium* sp., H. Morrison), 2 slides, 3 specimens (USNM).

FOREIGN SPECIMENS EXAMINED – Bermuda: Hamilton (XII-1913, host unknown, E. A. Back), 1 slide, 1 specimen (USNM); location unknown (VI-23-1921, *Codiaeum* sp., Kostal, Shermin, at New York), 1 slide, 1 specimen (USNM), (II-4-1932, *Euonymus* sp., C. A. Davis, at Boston), 1 slide, 1 specimen (USNM), (XII-3-1932, *Duranta repens*, A. O. Plummer, at New York), 1 slide, 3 specimens (USNM), (III-27-1935, *Rosmarinus* sp., O. G. Fitzgerald, at New York), 1 slide, 1 specimen (USNM), (XII-28-1936, *Euphorbia pulcherrima*, Locke, Post, at New York), 1 slide, 4 specimens (USNM), (III-27-1946, *Rosmarinus* sp., collector unknown), 2 slides, 2 specimens (USNM), (III-25-1954, *Tamarix* sp., A. G. Duston), 1 slide, 3 specimens (USNM).

Colombia: Volle (XI-5-1941, *Citrus limon*, B. Losada), 1 slide, 4 specimens (USNM).

Italy: Location unknown (IX-21-1966, *Clerodendron fragrans* 'Pleniflorum', R. J. Taylor), 1 slide, 2 specimens (USNM).

Jamaica: Location unknown (X-28-1895, *Euphorbia "hyperici"*, M. Grabham), 2 slide, 2 specimens (USNM).

Marshall Islands: Kwajalein Atoll, Kwajalein (date unknown, *Coccolobis* sp., R. P. Owen), 1 slide, 2 specimens (UH).

Mexico: Coahuila, Torreon (IX-1-1971, host unknown, J. W. Green, at El Paso), 2 slides, 5 specimens (USNM); Guanajuato, location unknown (X-18-1970, *Psidium* sp., R. Ikeda, at El Paso), 1 slide, 1 specimen (USNM); Vera Cruz, Vera Cruz (V-1955, *Pluchea "odorata"*, N. L. H. Krauss), 1 slide, 1 specimen (USNM).

Philippines: "Laguna" (IV-13-1970, *Ardisia "pyramidalis"*, Mabry, Pifer, Lightfield, at Washington, D. C.), 1 slide, 1 specimen (USNM), Quezon City (VIII-10-1962, *Chrysophyllum cainito*, C. R. Baltazar), 1 slide, 3 specimens (USNM), locality unknown (I-17-1968. *Psidium* sp., Nakamura, at Hawaii), 1 slide, 3 specimens (USNM), (VIII-19-1970, host unknown, Firestone, at Guam), 1 slide, 1 specimen (USNM), (IX-27-1971, *Vanda "aurora"*, Muniapan, at Guam), 1 slide, 1 specimen (USNM).

Trinidad: Location unknown (VII-29-1935, *Memmea* sp., D. Plimber, at Washington, D. C.), 1 slide, 1 specimen (USNM), (*Passiflora quadrangularis*, D. Plimber, at Washington, D. C.), 1 slide, 4 specimens (USNM).

Virgin Islands: St. Croix (XII-21-1953, *Malpighia* sp., D. C. Hamilton), 1 slide, 6 specimens (USNM).

Wake Island: Location unknown (date unknown, *Pisonia* sp., E. J. Ford), 1 slide, 2 specimens (USNM).

HOSTS AND DISTRIBUTION – *C. cirripediformis* was first collected in the U.S. in Florida in 1880. This species is probably native to the Caribbean Islands and the southern U. S., since older collections were made in this general region. A Maryland infestation was introduced on nursery stock of *Gardenia* possibly from Georgia or California. Because the host plants have been kept in a greenhouse during the winter, it remains to be observed whether *cirripediformis* can overwinter outdoors in Maryland. Outside of the U.S., this species is now widespread, with records from Hawaii and several other Pacific Islands, Mexico, northern South America, and the Caribbean Islands.

The host list for this species is extensive. Preferred hosts in the U.S. include *Citrus* and *Gardenia*.

ECONOMIC IMPORTANCE – *C. cirripediformis* is an economic pest of *Citrus* and many ornamentals. It does not secrete as much honeydew as *ceriferus*, but the quantities are sufficient to support the growth of sooty-mold fungi which may cause a reduction in the amount

of photosynthesis and thus a general decline in plant vigor. Heavy populations create an unsightly appearance and cause concern among ornamentalists.

BIOLOGY – Only biological characteristics of apparent taxonomic importance are given here; a more detailed biological treatment will be presented in a future paper. *C. cirripediformis* crawlers normally settle on the upper leaf surfaces along the main veins. Third instars usually migrate from the leaves to the stems soon after molting. Individual wax tests remain distinct even in heavy infestations. Males are here recorded for this species.

DISCUSSION – *C. cirripediformis* is characterized as follows: with capitate dorsal setae; with 1 ventral seta on each anal plate; with about 30 stigmatic setae laterad of each stigmatic furrow which are mainly isosceles with bluntly rounded or pointed apices; without filamentous ducts; multilocular pores present on all abdominal segments and near the meso- and metathoracic legs; legs with tibiotarsal scleroses, with equal claw digitules; antennae 7-segmented.

Of the foreign species examined, *marmoreus* Cockerell and *purpurellus* Cockerell most nearly resemble *cirripediformis*. *C. marmoreus* differs from *cirripediformis* in possessing from 10-15 stigmatic setae laterad of each stigmatic furrow which are predominantly equilateral with bluntly rounded apices. Whereas, *cirripediformis* possesses from 17-55 stigmatic setae laterad of each stigmatic furrow which are predominantly isosceles, with pointed apices. *C. purpurellus* differs from *cirripediformis* as follows: with 3 ventral setae on each anal plate; without capitate dorsal setae; with from 15-18 stigmatic setae laterad of each stigmatic furrow which are predominantly bullet-shaped, with bluntly rounded apices. Whereas, *cirripediformis* possesses: 1 ventral seta on each anal plate; capitate dorsal setae; from 17-55 stigmatic setae laterad of each stigmatic furrow which are predominantly isosceles, with pointed apices.

In the U.S., *cirripediformis* most nearly resembles *cistudiformis* and *sinensis*. *C. cistudiformis* differs from *cirripediformis* in possessing stigmatic setae which are predominantly equilateral, with bluntly rounded or truncate apices, and arranged in 5 or 6 irregular rows. Whereas, *cirripediformis* possesses stigmatic setae which are mainly isosceles, with pointed apices, and arranged in 2 or 3 irregular rows. *C. sinensis* differs from *cirripediformis* as follows: without capitate dorsal setae; with 2 ventral setae on each anal plate; with stigmatic setae which are either hemispherical, or bullet-shaped with rounded or pointed apices, or lanceolate with apical third bent; with a ventral submarginal band of filamentous ducts; without multilocular pores on abdominal segments 2 and 3. Whereas, *cirripediformis* possesses: capitate dorsal setae; 1 ventral seta on each anal plate; stigmatic setae which are predominantly isosceles with pointed apices, the apical third never bent; no ventral submarginal band of filamentous ducts; multilocular pores on all abdominal segments.

Ceroplastes cistudiformis Cockerell
Suggested Common Name: Tortoise Wax Scale
Figures 4(4), 6(4), 15, 16.

Ceroplastes sp., Townsend, 1892, p. 255.
Ceroplastes psidii cistudiformis Cockerell, 1893c, p. 104.
Ceroplastes cistudiformis Townsend and Cockerell, Cockerell, 1896d, p. 331.

TYPE DATA – The type locality is Guanajuato, Mexico, and *Bignonia* sp. and *Chrysanthemum* sp. are the type hosts. Cockerell did not designate a holotype specimen in his original description of this species. One adult female mounted on a slide labeled, "from Type Material" is in very poor condition. One adult female was mounted from dry syntype material from a box labeled, "Ceroplastes cistudiformis Towns. & Ckll. Bignonia & Chrysanthemum 100 Ckll Coccidae 5813 Jan 3, '94, Guanajuato Mexico (Coll A Duges) TYPE." One note inside this box, "5813 from Cockerell Jan 3, 94", indicates when the USNM received this material. A second note from A. Duges is an inquiry as to the identity of the scales. A third label contains the following information, "Ckll. Coccidae 100. TYPE. *Ceroplastes psidii* subsp., cistudiformis, Ckll. (Towns. M. S.) on *Bignonia* and *Chrysanthemum*. Guanajuata, Mexico coll. A Duges." We here designate as lectotype the specimen (1 adult female on 1 slide), mounted from the dry syntype material. The labels on this slide have the following information: right label, *"Ceroplastes cistudiformis* Ckll. Lectotype DET. W. F. GIMPEL", left label, "Mexico Guanajuato 1.3.1894 Ex *Bignonia* and *Chrysanthemum* A. Duges coll. DET. W. F. GIMPEL Mounted III.13.1971." We also designate as

paralectotype (1 adult female on 1 slide) labeled as follows: *"Ceroplastes cistudiformis* (Towns. & Ckll) Guanajuato, Mex. Dr. Duges, Coll. From Type Material (Ckll. coll.)." Unmounted dry paralectotypes are in a box labeled with the information given previously. The lectotype and paralectotypes are deposited in the USNM.

FIELD CHARACTERS – The following description is based on dry material used by Cockerell for the original description of this species.

Test: wet wax oval in dorsal view, hemispherical laterally, without horn, yellowish brown, without marginal flange, divided into 1 dorsal and 6 lateral plates, with nuclei. Dry wax filaments not seen; dorsal dry wax of first and second instars forming small central cap, surrounded by dorsomedial nucleus, dorsal dry wax not tilted. Stigmatic wax bands present near both pairs of spiracles, anterior bands directed dorsally, filamentous wax confined to stigmatic areas. Length 4.0 mm (2.5-7.2), width 3.8 mm (2.0-6.0), height 3.5 mm (2.0-5.0).

Body: oval, chestnut brown; anal process short.

SLIDE MOUNTED CHARACTERS – Adult female elliptical, length 4.0 mm (1.5-7.0), width 3.0 mm (1.0-5.0).

Dorsum: membranous in young adult females, slightly sclerotized in older adult females; with 1 cephalic, 1 mediodorsal, and 6 lateral clear areas devoid of pores and setae, except cephalic area with 1 or 2 cylindrical setae; dorsal setae variable (fig. 6(4)), about 25.0 cylindrical setae with pointed or blunt apices, 5.2 μ (4.6-6.1) long and about 45.0 capitate setae, 4.4 μ (3.4-5.2) long. Dorsal pores distributed as follows: about 150 bilocular pores evenly distributed; about 1800 oval trilocular pores evenly distributed, triangular trilocular pores variable 600 (0-900), evenly distributed; about 40.0 quadrilocular pores mainly located in mesal area; quinquelocular pores absent. Tubular ducts absent. Anal plates each with 1 ventral and 4 dorsal setae.

Margin: marginal bristle-shaped setae 23.7 μ (19.6-27.8) long, placed as follows: 6.0 (5.0-7.0) between eye tubercles, 3.0 (2.0-4.0) between each eye tubercle and each anterior stigmatic furrow, 3.0 (2.0-4.0) between each anterior and posterior stigmatic furrow, 10.0 (9.0-11.0) between each posterior stigmatic furrow and anal cleft, last 3-5 longer, 43.0 μ (21.8-56.0) in cluster on anal lobes; stigmatic setae equilateral to isosceles, with rounded, truncate, or pointed apices (fig. 4(4)), length 1.0 to 1.5 times greater than width at base, 34.0 (20.0-60.0) laterad of each stigmatic furrow in 5 or 6 irregular rows, length from 5.0-14.0 μ long. Filamentous ducts absent. Eye tubercles slightly protruding.

Venter: membranous; bristle-shaped setae placed as follows: 40.0 (34.0-45.0) on each submargin, 11.8 μ (8.7-15.3) long, 2.0 (1.0-4.0) associated with each coxa, 6.0 (4.0-7.0) in cephalic region, 6.0 (3.0-12.0) on each abdominal and thoracic segment; interantennal space with 1 or 2 pairs of lateral bristle-shaped setae 13.3 μ (10.9-15.3) long, 1 pair of mesal bristle-shaped setae 51.3 μ (43.7-65.0) long; 1 pair of mesal bristle-shaped setae 50.4 μ (42.7-78.3) long on segment 8 anterior to vulva, surrounded by 2 or 3 pairs of short bristle-shaped setae 11.9 μ (8.7-15.2) long. About 900 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous toward meson; 73.0 (56.0-79.0) stigmatic pores in band in each stigmatic furrow, extending from spiracular atrium to stigmatic setae, most furrows solely with quinquelocular pores, occasionally with several pores with more than 5 loculi; about 300 multilocular pores surround vulva, 200 (75-300) on seventh abdominal segment, 15.0 (4.0-43.0) on each preceding abdominal segment, 2.0 (1.0-3.0) near base of each meso- and metacoxa, absent from prothorax. Tubular ducts with slightly asymmetrical cups, each duct with inner filament nearly as long and much narrower than basal part of duct, arranged in 2 clusters as follows: 22.0 (16.0-34.0) in cephalic region; 24.0 (16.0-37.0) in region of vulva, occasionally extending anteriorly to fourth abdominal segment. Legs 392.0 μ (348.0-434.0) long; tibia without basal setae, tibia less than 2 times length of tarsus, with tibiotarsal scleroses; tarsal digitules 56.6 μ (43.6-65.5) long; with equal claw digitules 29.5 μ (26.2-32.7) long; claws without denticles; length of leg segments as follows: coxa 68.0 μ (60.7-75.6), trochanter plus femur 160.0 μ (147.7-178.0), tibia 107.7 μ (96.0-120.0), tarsus 64.8 μ (43.6-74.2), claw 21.3 μ (19.3-21.8) long. Antennae 7-segmented, occasionally 6-segmented, 285.6 μ (246.0-315.0) long.

SPECIMENS EXAMINED – California: Los Angeles Co., Claremont (II-11-1897, *Schinus* sp., A. L. Cook), 1 slide, 1 specimen (USNM); San Diego Co., Escondido (1-20-1935, *Passiflora* sp., F. R. Platt), 1 slide, 4 specimens (USNM), San Diego (1909, *Citrus* sp., E. R. Sasscer), 2 slides, 4 specimens (USNM).

FOREIGN SPECIMENS EXAMINED – Cuba: Triscornia (X-10-1921, *Porana paniculata*, C. H. Ballou), 1 slide, 2 specimens (USNM).

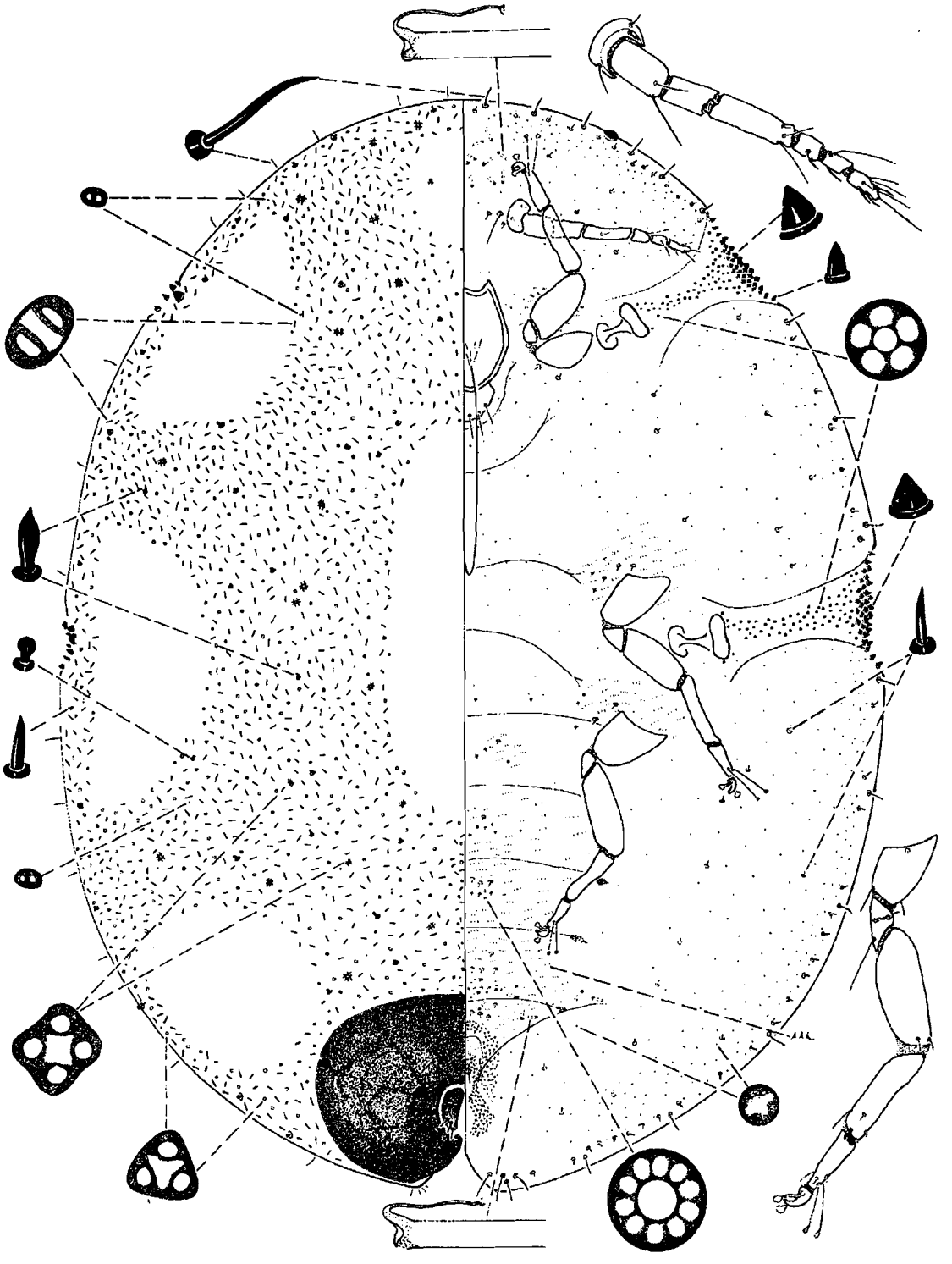


Figure 15. *Ceroplastes cistudiformis.* Slide mounted adult female. California, San Diego Co., San Diego (1909, *Citrus* sp.) (also see fig. 16).

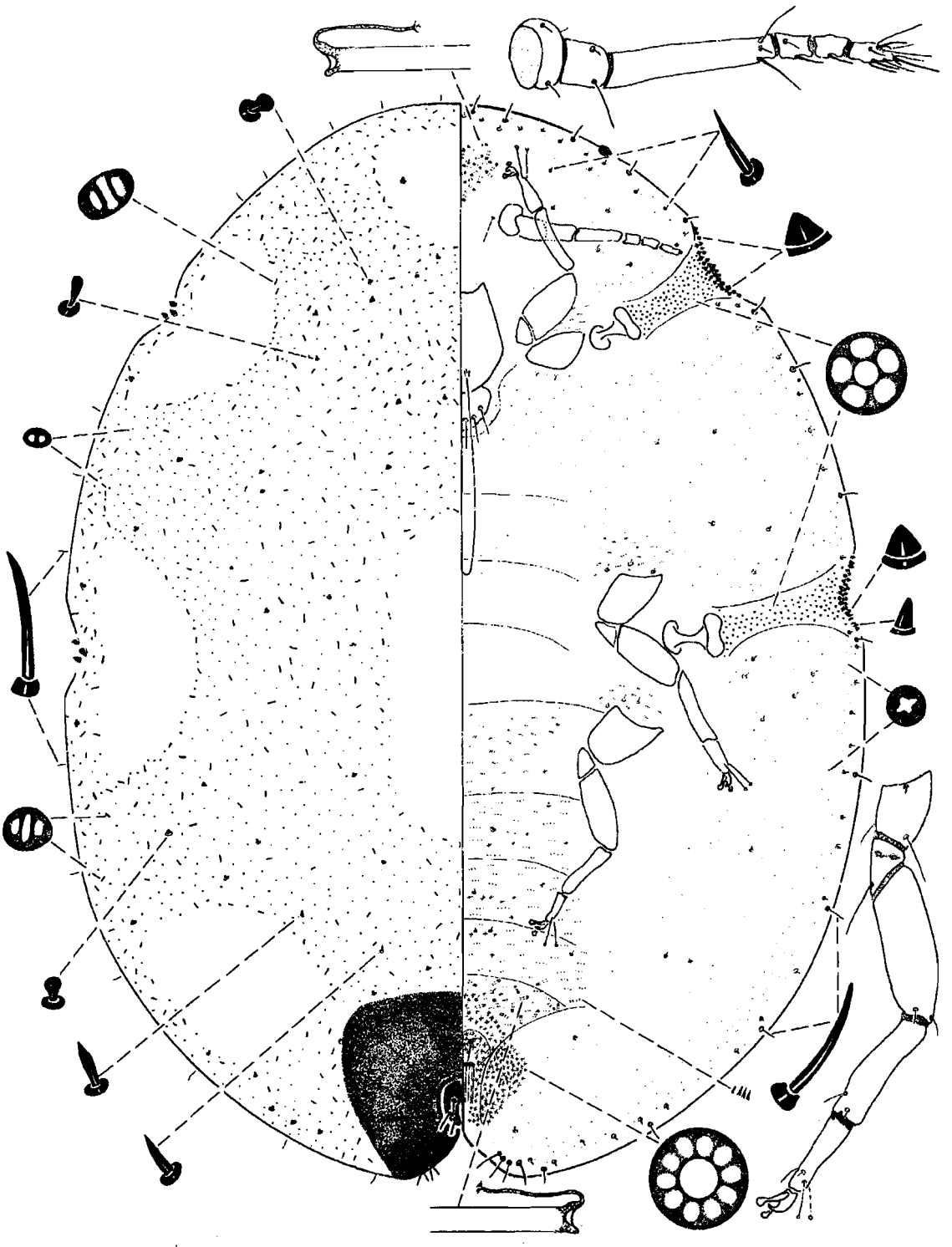


Figure 16. *Ceroplastes cistudiformis.* Slide mounted adult female. California, San Diego Co., San Diego (1909, *Citrus* sp.) (also see fig. 15).

Mexico: Distrito Federal, Mexico City (XII-6-1897, host unknown, collector unknown), 1 slide, 1 specimen (USNM); Guanajuato, Guanajuato (I-3-1894, *Bignonia* sp., and *Chrysanthemum* sp., A. Duges), 7 slides, 7 specimens (USNM), (date unknown, host unknown, A. Duges), 2 slides, 3 specimens (USNM); Jalisco, Tonila (VII-1903, *Parthenium* sp., collector unknown), 1 slide, 1 specimen (USNM); Veracruz, Tampico (1-26-1897, *Cordia boissieri*, collector unknown), 1 slide, 1 specimen (USNM); state unknown, Morenas (X-18-1897, *Panda* sp., A. Koebele), 1 slide, 3 specimens (USNM), Capetillo (XI-1902, *Bouvardia* sp., G. Bisen), 2 slides, 2 specimens (USNM), location unknown (date unknown, *Chysis aurea*, K. Jordan, at Tring, England), 1 slide, 1 specimen (USNM), (host unknown, C.H.T. Townsend), 2 slides, 4 specimens (USNM), (collector unknown), 2 slides, 4 specimens (UCD).

HOSTS AND DISTRIBUTION – Based on our records, *cistudiformis* was first collected in the U. S. in California in 1897. This species is probably native to Mexico. In the U. S. it is recorded only from California, although it probably occurs in other southwestern states. Outside of the U. S. it is known from the Greater Antilles, Mexico, and Guatemala. It has also been reported from Hawaii, but these are misidentifications of *cirripediformis*.

The host list is diverse, making it difficult to indicate a preferred host.

ECONOMIC IMPORTANCE – *C. cistudiformis* is currently not of concern as a pest species, although its occurrence on *Citrus* in southern California should alert economic entomologists to its potential as a possible pest in the future.

BIOLOGY – There is no available biological information for *cistudiformis*, although the life history of this species is likely to be similar to *cirripediformis* and *sinensis*.

DISCUSSION – *C. cistudiformis* is characterized as follows: normally with capitate dorsal setae; with 1 ventral seta on each anal plate; with about 34 stigmatic setae laterad of each stigmatic furrow which are arranged in 5 or 6 rows and with the larger stigmatic setae predominantly equilateral with rounded or truncate apices and the smaller setae equilateral to lanceolate with pointed apices, without filamentous ducts; multilocular pores present on all abdominal segments and near the meso- and metathoracic legs; legs with tibiotarsal scleroses, with equal claw digitules; antennae normally 7-segmented.

Of the foreign species examined, *marmoreus* most nearly resembles *cistudiformis*. *C. marmoreus* differs in possessing 9-12 stigmatic setae laterad of each stigmatic furrow which are arranged in 2 or 3 irregular rows. Whereas, *cistudiformis* possesses 20-60 stigmatic setae laterad of each stigmatic furrow which are arranged in 5 or 6 irregular rows. *C. cistudiformis* was originally described as a subspecies of *psidii* Chavannes, however, based only on examination of a single specimen of *psidii* these species appear to be quite different. *C. psidii* possesses: no capitate dorsal setae; isosceles stigmatic setae; 3 irregular rows of stigmatic setae laterad of each stigmatic furrow. Whereas, *cistudiformis* possesses: many capitate dorsal setae; equilateral and isosceles stigmatic setae; 5 or 6 irregular rows of stigmatic setae laterad of each stigmatic furrow.

In the U.S. *cistudiformis* most nearly resembles *cirripediformis*. For a comparison of differences, see the discussion section of *cirripediformis*.

Ceroplastes dugesii Lichtenstein
Suggested Common Name: Duges Wax Scale
Figures 4(5), 6(5), 17, 18, 19

Ceroplastes dugesii Lichtenstein, 1885, p. 141.
Ceroplastes dugesii "Lichtenstein m. s. Townsend"; Cockerell, 1893d, p. 373.
Ceroplastes ceriferus (Anderson), Cockerell, 1893d, p. 373 [Misidentification].
Ceroplastes dugesii Townsend; Cockerell, 1893e, p. 100.
Ceroplastes roseatus Townsend and Cockerell, 1898, p. 176 [New synonymy].
Ceroplastes townsendi Cockerell, 1899, p. 1 [New synonymy].
Ceroplastes dugesii Lichtenstein; Maxwell-Lefroy, 1902, p. 257.
Ceroplastes roseatus var. B. Cockerell, 1903, p. 157 [New synonymy].
Ceroplastes townsendi var. *percrassus* Cockerell, 1903, p. 159 [New synonymy].

TYPE DATA – The type locality is the state of Guanajuato, Mexico. The types according to Lichtenstein were collected on "Hybiscus [sic] sur le *Ficus sphaerocarpa*, sur le Laurie, rose, etc. . . ."

It has been impossible to locate positive type material, although we have examined a topotype specimen labeled as follows: "Ceroplastes dugesii "Licht." Towns. Type Guanajuato, Mexico A. Duges, Colr. Jan. 4, 1894 5468.". This specimen was received by Pergande at the USNM January 4, 1894 from Cockerell, who probably received the specimen from Townsend.

We have examined types of *roseatus, roseatus* var. B, *townsendi*, and *townsendi* var. *percrassus* and consider these species to be junior synonyms of *dugesii*.

Throughout the literature on *dugesii* there has often been confusion about the authorship of the species. Cockerell (1893e) regarded Lichtenstein's use of *dugesii* as a manuscript name and credited Townsend with the authorship. Maxwell-Lefroy (1902) regarded Lichtenstein as the author. De Lotto (1971) points out that descriptive characters were given concerning *dugesii* by Lichtenstein (1885), and we therefore attribute the authorship to Lichtenstein.

FIELD CHARACTERS -- The following description is based on fresh material.

Test: wet wax oval in dorsal view, volcano shaped or hemispherical laterally, without horn, white, without marginal flange, plates, and nuclei. Dry wax with filaments as follows: cephalic filament appearing trifurcate, with acute apices; anterolateral, mediolateral, and posterolateral filaments simple; caudal filaments with weakly divided bifurcate apices; dorsal dry wax of first and second instars forming small central cap, not surrounded by nucleus; dorsal dry wax tilted anteriorly. Stigmatic wax bands present near both pairs of spiracles, anterior bands directed dorsally, filamentous wax present around ventral margin, most abundant in spiracular areas. Length 8.0 mm (4.0-14.5), width 6.0 mm (3.5-12.5), height 3.0 mm (2.0-6.0).

Body: elliptical, light brown; anal process long on older adult females.

SLIDE MOUNTED CHARACTERS – Adult female oval, length 6.5 mm (3.0-8.2), width 5.0 mm (1.0-7.3).

Dorsum: membranous in young adult females, slightly sclerotized in older adult females; with 1 cephalic, 1 mediodorsal, and 6 lateral clear areas devoid of pores and setae except cephalic area with from 2-4 cylindrical setae; dorsal setae variable (fig. 6(5)), about 180 cylindrical setae with bluntly rounded to slightly expanded apices, 5.0 μ (4.0-7.8) long. Dorsal pores distributed as follows: bilocular pores variable 210 (100-710), evenly distributed; about 1300 oval trilocular pores evenly distributed, triangular trilocular pores variable 110 (50-270), evenly distributed; quadrilocular pores variable 14 (0-30) mainly located in mesal area; quinquelocular pores absent. Tubular ducts absent. Anal plates each with 3 ventral and 4 dorsal setae.

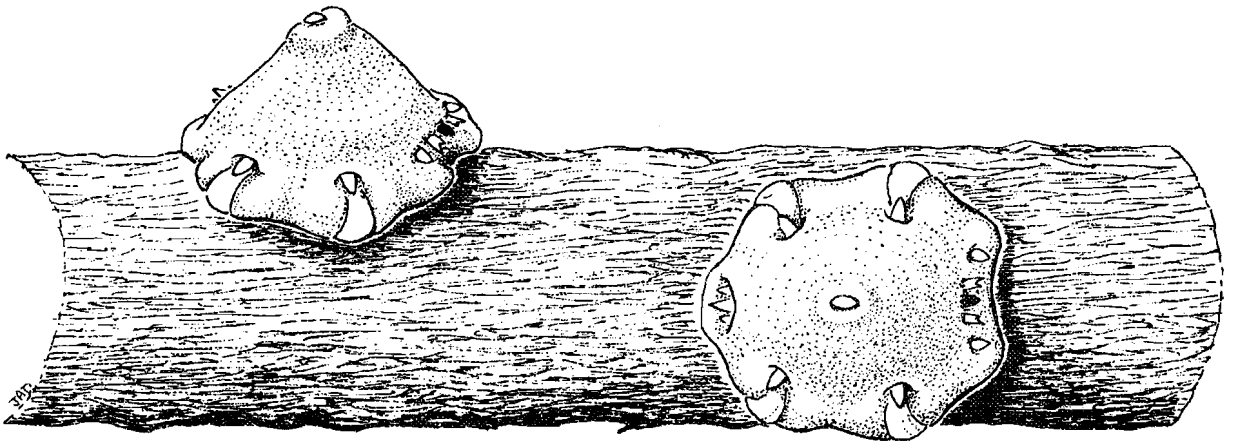


Figure 17. *Ceroplastes dugesii*. Wax test adult female. Florida, Saint Lucie Co., Fort Pierce (VII-14-1972, *Bursera simaruba*).

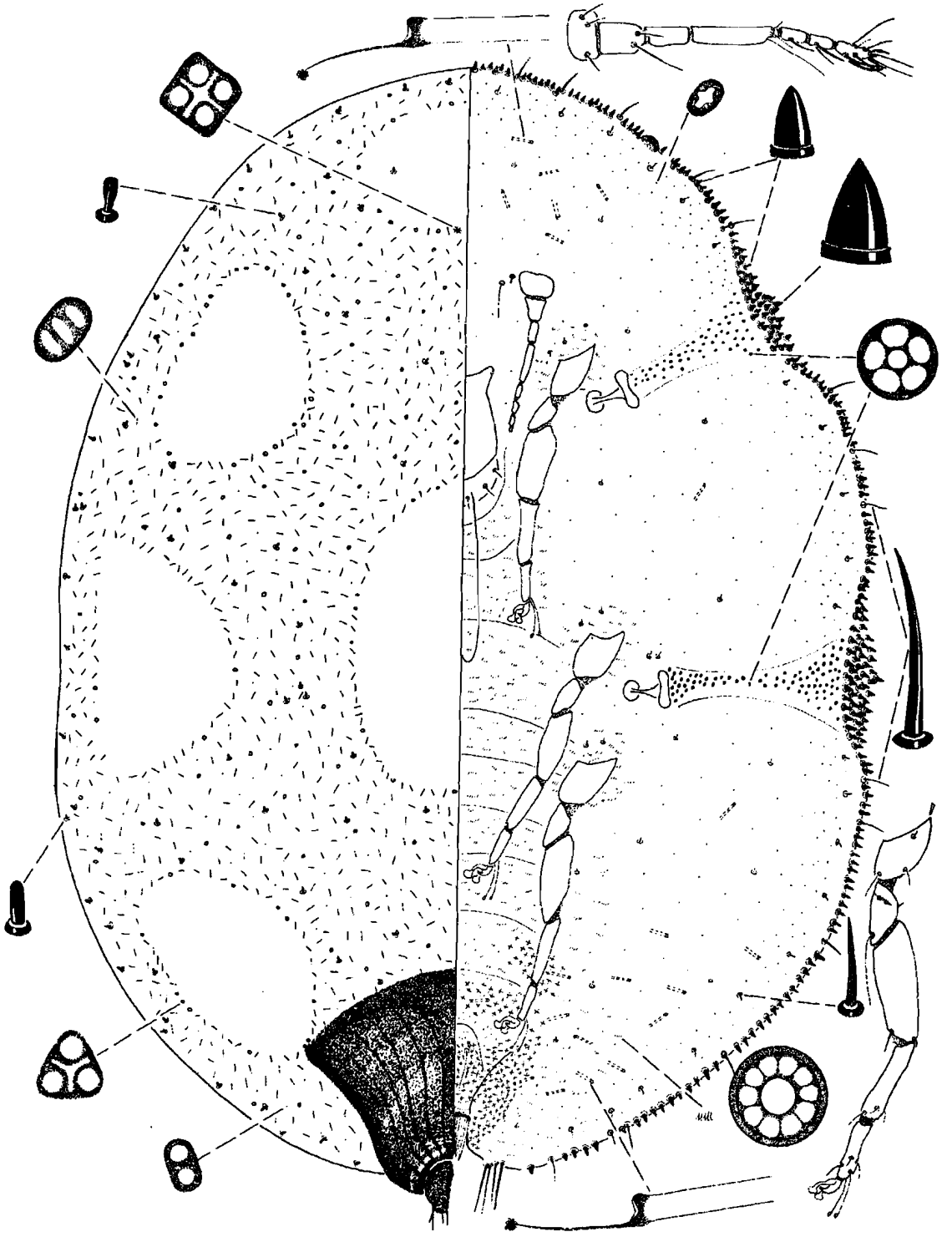


Figure 18. *Ceroplastes dugesii.* Slide mounted adult female. Panama, other data unknown. (also see fig. 19).

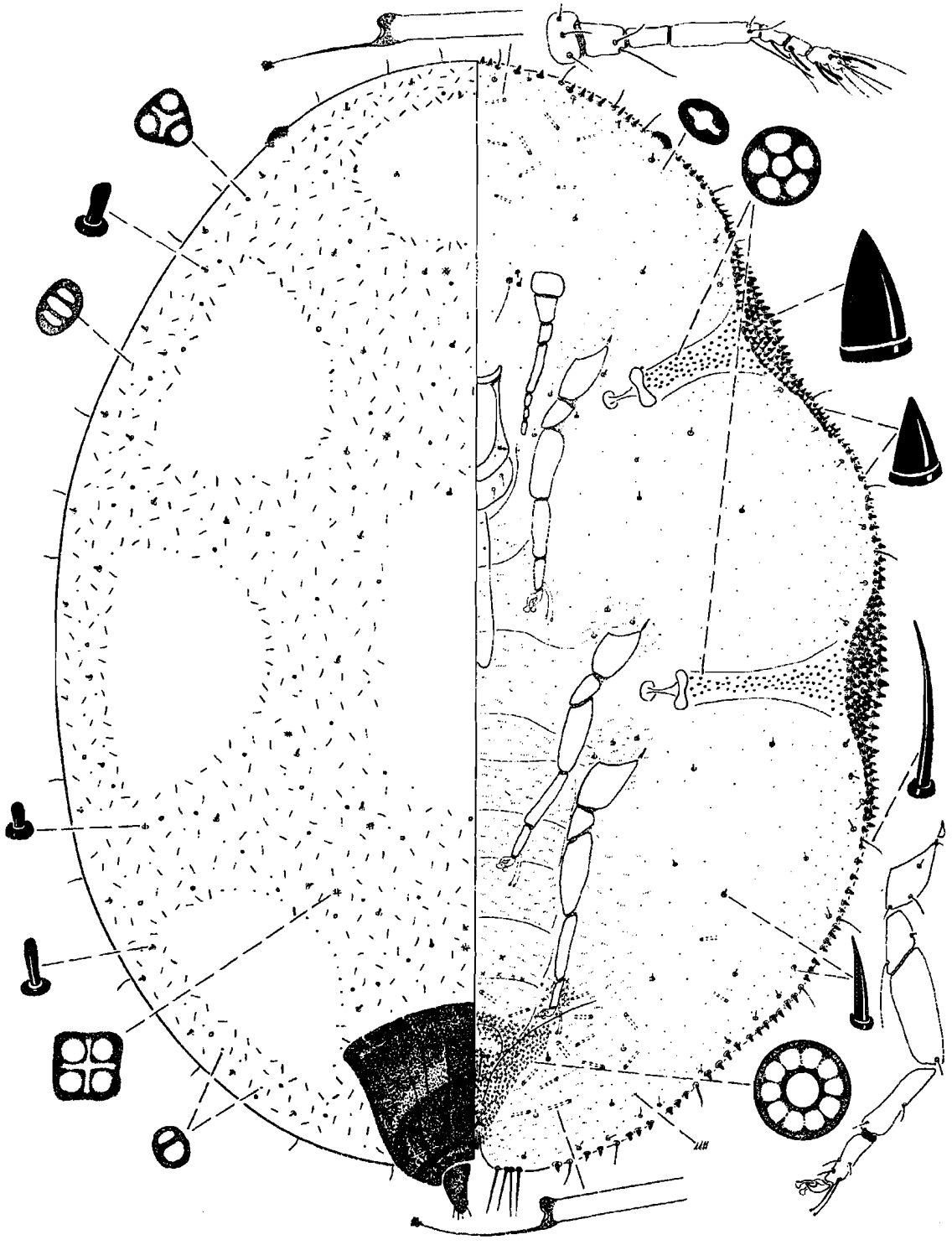


Figure 19. *Ceroplastes dugesii.* Slide mounted adult female. Florida, Saint Lucie Co., Fort Pierce (III-28-1972, *Bursera simaruba)* (also see fig. 18).

Margin: marginal bristle-shaped setae 29.6 μ (19.5-39.3) long, placed as follows: 8.0 (6.0-9.0) between eye tubercles, 2.0 (1.0-3.0) between each eye tubercle and each anterior stigmatic furrow, 3.0 (3.0-4.0) between each anterior and posterior stigmatic furrow, 10.0 (9.0-14.0) between each posterior stigmatic furrow and anal cleft, last 3-5 thicker, longer, 64.6 μ (43.6-97.5), in cluster on anal lobes; stigmatic setae lanceolate to bullet-shaped, with pointed apices, occasionally with apical portion curved (fig. 4(5)), length 1.0 to 2.5 times greater than width at base, 468.0 (306.0-570.0) around entire margin, with clusters laterad of each stigmatic furrow formed by 5-7 irregular rows, these irregular rows tapering to 1 or 2 rows on remainder of margin, number of setae between eye tubercles variable from 15.0-48.0, length from 10.4-40.7 μ long. Filamentous ducts absent. Eye tubercles slightly protruding.

Venter: membranous; bristle-shaped setae placed as follows: 30.0 (22.0-35.0) on each submargin, 12.0 μ (8.7-19.6) long, 3.0 (1.0-4.0) associated with each coxa, 3.0 (1.0-5.0) in cephalic region, 4.0 (2.0-7.0) on each abdominal and thoracic segment; interantennal space with 2 pairs of lateral bristle-shaped setae 10.1 μ (8.7-10.9) long, 1 pair of mesal bristle-shaped setae 65.5 μ (26.2-111.0) long; 1 pair of mesal bristle-shaped setae 71.9 μ (54.5-87.0) long on segment 8 anterior to vulva, surrounded by 2 or 3 pairs of short bristle-shaped setae 12.0 μ (8.7-19.6) long. About 900 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous toward meson; 140.0 (90.9-235.0) stigmatic pores in irregular band in each stigmatic furrow, extending from spiracular atrium to stigmatic setae, most furrows predominantly with quinquelocular pores, occasionally with several pores with more than 5 loculi; about 550 multilocular pores surround vulva, 140.0 (70.0-180.0) on seventh abdominal segment, 50.0 (13.0-100.0) on sixth abdominal segment, absent from remaining abdominal and thoracic segments. Tubular ducts with symmetrical cups, each duct with inner filament nearly as long and much narrower than basal part of duct, arranged in 2 clusters as follows: 21.0 (8.0-49.0) in cephalic region; 30.0 (22.0-44.0) in region of vulva, some specimens with 1 or 2 tubular ducts between each anterior and posterior stigmatic furrow. Legs 476.0 μ (375.0-568.0) long; tibia without basal setae, tibia less than 2 times length of tarsus, with tibiotarsal scleroses; tarsal digitules 60.6 μ (54.5-75.5) long; with equal claw digitules 38.7 μ (32.7-45.0) long; claws without denticles; length of leg segments as follows: coxa 73.5 μ (65.5-87.3), trochanter plus femur 195.0 μ (174.0-231.0), tibia 125.0 μ (97.0-151.0), tarsus 77.3 μ (65.4-97.5), claw 25.0 μ (21.8-30.5) long. Antennae 7-segmented, occasionally 6-segmented, 350.0 μ (283.0-471.0) long.

SPECIMENS EXAMINED – **Florida:** Dade Co., near Cutler (I-2-1914, "gum elemi", C. Mosier), 1 slide, 1 specimen (USNM), 2 mi. west of Homestead, Sykes Hammock (IV-12-1919, *Bursera simaruba*, C. Mosier), 3 slides, 5 specimens (USNM), Miami, Bickell Hammock (V-10-1919, *Trema mollis*, A. Mason), 1 slide, 1 specimen (USNM); Palm Beach Co., West Palm Beach (IV-24-1908, "gum elemi", J. Beach), 4 slides, 4 specimens (USNM); Polk Co., Winter Haven (VII-1-1913, *Diosypros silvestris*, W. Yothers), 2 slides, 2 specimens (USNM); Saint Lucie Co., Fort Pierce (I-25-1972, *Bursera simaruba*, E. Campbell), 9 slides, 9 specimens (WG) (III-28-1972, *Bursera simaruba*, E. Campbell), 1 slide, 1 specimen (WG); Co. unknown, Lake Elbert (IV-6-1916, *Diospyros* sp., E. Berger), 4 slides, 6 specimens (USNM).

FOREIGN SPECIMENS EXAMINED – **Cuba:** El Retiro, Taco Taco (IV-1-1922, host unknown, Bruner, Acuna, C. H. Ballou), 1 slide, 1 specimen (USNM).

Mexico: Distrito Federal (VII-21-1939, "Peru tree", A. C. Baker), 1 slide, 1 specimen (USNM), (VI-25-1944, *Schinus molle*, W. E. Stone), 1 slide, 1 specimen (USNM), (III-31-1952, *Nerium oleander*, O. Hecht), 1 slide, 4 specimens (USNM); Guanajuato, location unknown (I-4-1894, host unknown, A. Duges), 1 slide, 1 specimen (USNM); Jalisco, Zapotlan (VII-7-1902, *Nerium oleander, Ficus*, C. H. T. Townsend, Boyd), 1 slide, 1 specimen (USNM), (VII-1903, *"Irapuato"* sp., *Ficus* sp. C.H.T. Townsend, Boyd), 1 slide, 1 specimen (USNM); Tabasco, near Frontera, Arroya San Isidro (V-27-1897, host unknown, collector unknown), 5 slides, 6 specimens (USNM), location unknown (VI-18-1897, "Cojon de Vanado", C.H.T. Townsend), 1 slide, 1 specimen (USNM); state unknown, location unknown (date unknown, *Malva* sp., collector unknown), 4 slides, 13 specimens (USNM).

Panama: Canal Zone, Ancon (VI-14-1926, *Piper* sp., J. Zetek), 1 slide, 2 specimens (USNM); (date unknown, host unknown, T.D.A. Cockerell), 5 slides, 10 specimens (USNM).

Virgin Islands: St. Croix (III-27-1961, *Annona* sp., C. W. Meskimon), 1 slide, 4 specimens (USNM).

West Indies: Barbados (VII-27-1900, *Bursera gemmifera*, D. Morris), 2 slides, 2 specimens (USNM).

HOSTS AND DISTRIBUTION – *C. dugesii* has not previously been recorded from the U.S. Although it was collected as early as 1908 in Florida, it was misidentified as *ceriferus*. *C. dugesii* is probably native to Mexico and/or some of the Caribbean Islands. The known distribution extends from Panama to Florida. In the U.S. it is known only from Florida, but probably also occurs in several other southern states along the Gulf of Mexico and in southern Georgia.

Based on the material available, this species is rather polyphagous and therefore it is difficult to indicate preferred hosts.

ECONOMIC IMPORTANCE – *C. dugesii* is currently not of concern as a pest species, but its occurrence on a wide range of ornamental hosts should cause concern in regard to its pest potential in the future.

BIOLOGY – The only available biological information in regard to *dugesii* is that the adult females are found on the stems of their hosts. However, a more detailed biological study is presently in progress and the results of that study will be presented in a future paper.

DISCUSSION – *C. dugesii* is characterized as follows: dorsal setae predominantly cylindrical with rounded apices; with 3 ventral setae on each anal plate; stigmatic setae not confined to stigmatic areas but with about 468 such setae present around entire body margin, stigmatic setae lanceolate to bullet-shaped with pointed apices, apical third sometimes bent; without filamentous ducts; multilocular pores present on abdominal segments 6-8; with appendages unusually long, legs about 476 μ long and antennae about 350 μ long; legs with tibiotarsal scleroses, with equal claw digitules; antennae normally 7-segmented.

Of the foreign species examined, *circumdatus* Green and *scutigera* Cockerell most nearly resemble *dugesii*. *C. circumdatus* and *scutigera* differ as follows: with 1 ventral seta on each anal plate; with from 48-55 setae on cephalic margin between eye tubercles; with 3 or 4 rows of stigmatic setae laterad of each stigmatic furrow. Whereas, *dugesii* possesses: 3 ventral setae on each anal plate; 15-48 stigmatic setae on cephalic margin between eye tubercles; 5-7 rows of stigmatic setae laterad of each stigmatic furrow. *C. albolineatus* var. *vulcanicus* Cockerell also resembles *dugesii*, but differs in having dorsal setae predominantly with pointed apices, whereas, in *dugesii* these setae have predominantly rounded apices. Other differences could not be determined due to the poor condition of the single available specimen of *albolineatus* var. *vulcanicus*.

In the U.S. *dugesii* can be separated from all other species of *Ceroplastes* in possessing stigmatic setae around the entire body margin.

Ceroplastes floridensis Comstock
ESA Approved Common Name: Florida Wax Scale
Figure 5(1), 6(6), 20, 21, 22

Ceroplastes rusci (Linn.); Ashmead, 1880, p. 252 [Misidentification].
Ceroplastes floridensis Comstock, 1881, p. 331.
Cerostegia floridensis (Comstock); De Lotto, 1969a, p. 211.

TYPE DATA – The type locality is the state of Florida. Comstock lists the following 13 hosts in his original description: *Citrus* sp., *Ficus* sp., *Punica* sp., *Psidium* sp., *Camellia* sp., *Cydonia* sp., *Prunus salicina, Persea* sp., *Thevetia* sp., *Laurus* sp., *Ilex glabra, Myrtus* sp., and *Andromeda* sp. Comstock did not designate a holotype specimen in his original description of this species. We here designate as lectotype the specimen (1 adult female on 1 slide) labeled as follows: "*Ceroplastes floridensis* Comst. On Tangerine orange Jacksonville, Fla. Jan. 26, 1880 350." Based on Pergande notes stored in USDA files, it has been determined that this specimen is part of the original type series. We also designate as paralectotypes the specimens (3 adult females on 3 slides) labeled as follows: " *Ceroplastes floridensis* Comst. On Pomegranate Lake Bearford, Fla. Feb. 6, 1880 350; *Ceroplastes floridensis* Comst. On Japan Plum Ft. George, Fla. May 13, 1880; and *Ceroplastes floridensis* Comst. On *Persea borbonia* Ft. George, Fla. May 17, 1880." The lectotype and the paralectotypes are deposited in the USNM.

FIELD CHARACTERS – The following description is based on fresh material.

Test: wet wax rectangular in young adult females and oval in old females in dorsal view, nearly flat in young females and hemispherical in older specimens laterally, without horn, grayish to pinkish white, with large marginal flange in old females absent or small in young females not hiding lateral filaments, without plates and nuclei. Dry wax with filaments as follows: cephalic filament appearing trifurcate, with acute apices; anterolateral and mediolateral filaments simple; posterolateral filaments bifurcate; caudal filaments with weakly divided, bifurcate apices; dorsal dry wax of first and second instars forming small central cap, not surrounded by nucleus; dorsal dry wax not tilted. Stigmatic wax bands present near both pairs of spiracles, anterior bands directed dorsally, filamentous wax confined to stigmatic areas. Length 3.0 mm (1.5-4.0), width 2.0 mm (1.3-3.5), height 1.5 mm (1.0-2.0).

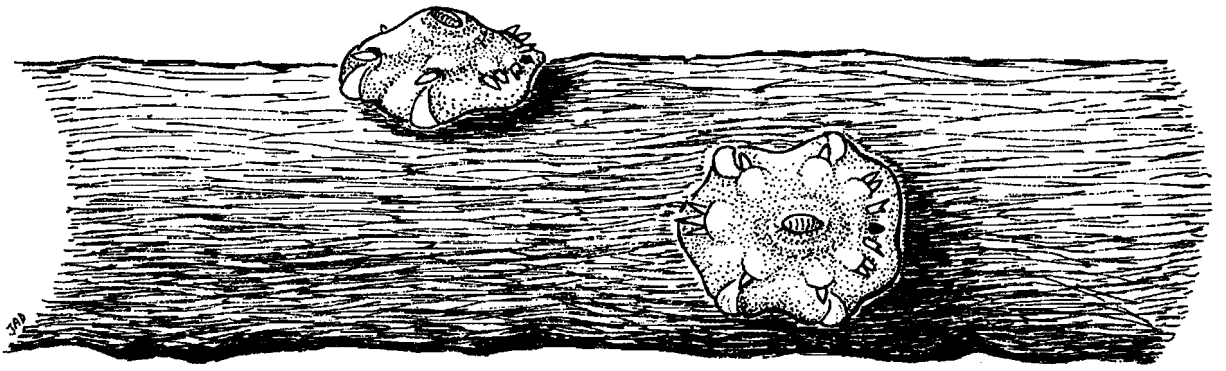


Figure 20. *Ceroplastes floridensis.* Wax test young adult female. Virginia, Montgomery Co., Blacksburg, University greenhouse (VII-15-1972, *Ilex cornuta* 'Burfordii').

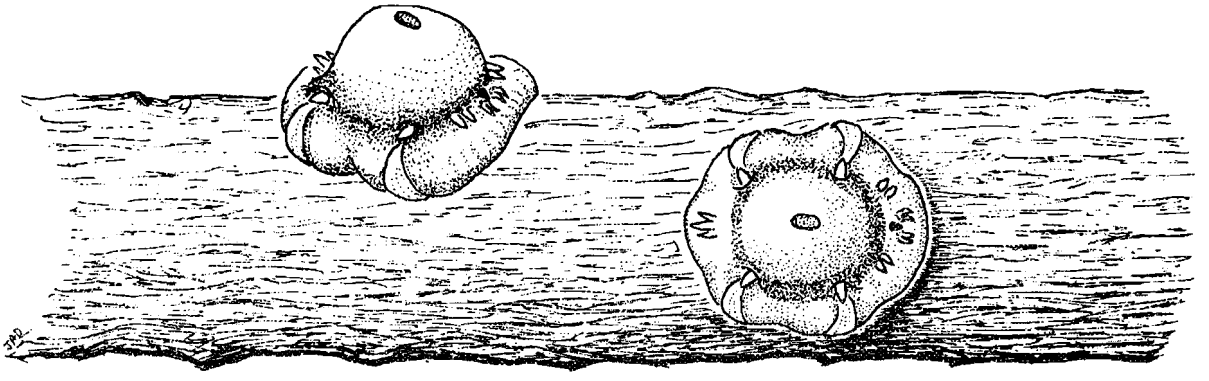


Figure 21. *Ceroplastes floridensis.* Wax test old adult female. Virginia, Montgomery Co., Blacksburg, University greenhouse (VII-15-1972, *Ilex cornuta* 'Burfordii').

Body: elliptical, reddish brown; anal process short.

SLIDE MOUNTED CHARACTERS – Adult female ellipitcal, length 2.0 mm (1.0-3.5), width 1.5 mm (0.8-2.0).

Dorsum: membranous in young adult females, slightly sclerotized in older adult females; with 1 cephalic, 0 mediodorsal, and 6 lateral clear areas devoid of pores and setae, except cephalic area with 2-4 cylindrical setae; dorsal setae relatively constant (fig. 6(6)), about 30 cylindrical setae with truncate apices, 4.4 μ (3.5-5.3) long. Dorsal pores distributed as follows: about 40 bilocular pores concentrated on submargin; about 500 oval trilocular pores concentrated on submargin, 150 triangular trilocular pores concentrated in mesal area; about 10 quadrilocular pores mainly located in mesal area; some specimens with a few quinquelocular pores. Tubular ducts absent. Anal plates each with 1 ventral and 3 or 4 dorsal setae.

Margin: marginal bristle-shaped setae 17.3 μ (12.7-23.0) long, placed as follows: 18.0 (17.0-25.0) between eye tubercles, 9.0 (8.0-10.0) between each eye tubercle and each anterior stigmatic furrow, 9.0 (8.0-10.0) between each anterior and posterior stigmatic furrow, 40.0 (35.0-50.0) between each posterior stigmatic furrow and anal cleft, last 4 longer, 56.0 μ (43.5-67.0), in cluster on anal lobes; stigmatic setae lanceolate with pointed apices (fig. 5(1)), length 1.5 to 2.5 times greater than width at base, 28.0 (22.0-34.0) laterad of each stigmatic furrow in 3 irregular rows, length from 10.5-23.3 μ long. Filamentous ducts absent. Eye tubercles slightly protruding.

Venter: membranous; bristle-shaped setae placed as follows: 35.0 (32.0-40.0) on each submargin, 8.6 μ (7.8-9.5) long, 3.0 (2.0-4.0) associated with each coxa, 11.0 (10.0-14.0) in cephalic region, 5.0 (2.0-12.0) on each abdominal and thoracic segment; interantennal space with 1 or 2 pairs of lateral birstle-shaped setae 24.4 μ (15.0-36.7) long, 1 pair of mesal bristle-shaped setae 55.0 μ (45.7-70.0) long; 1 pair of mesal bristle-shaped setae 63.0 μ (63.3-80.0) long on segment 8 anterior to vulva, surrounded by 2 or 3 pairs of short bristle-shaped setae 8.7 μ (7.8-9.5) long. About 500 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous towards meson; 65.0 (50.0-90.0) stigmatic pores in irregular band in each stigmatic furrow, extending from spiracular atrium to stigmatic setae; most furrows predominantly with quinquelocular pores, occasionally with several pores with more than 5 loculi; about 140 multilocular pores surround vulva, 50.0 (3.0-75.0) on seventh abdominal segment, 5.0 (3.0-12.0) on each preceding abdominal segment, 2.0 (0.0-3.0) near base of each coxa. Tubular ducts with asymmetrical cups, each duct with basal portion of inner filament greatly expanded, arranged in submarginal band 2-5 ducts wide, originating just below eye and ending just anterior to anal cleft, interrupted only by stigmatic furrows, placed as follows: 28.0 (18.0-31.0) between each eye and anterior stigmatic furrow; 27.0 (24.0-36.0) between each anterior and posterior stigmatic furrow; 67.0 (30.0-90.0) between each posterior stigmatic furrow and anal cleft. Legs 360.0 μ (337.0-450.0) long; tibia without basal setae; tibia less than 2 times length of tarsus, without tibiotarsal scleroses; tarsal digitules 50.3 μ (46.5-53.0) long; with equal claw digitules 30.7 μ (27.0-32.3) long; claws without denticles; length of leg segments as follows: coxa 63.7 μ (60.0-69.0), trochanter plus femur 130.0 μ (90.0-147.0), tibia 93.7 μ (75.0-112.5), tarsus 60.0 μ (51.0-63.0), claw 16.5 μ (15.7-17.3) long. Antennae 6-segmented, rarely 7-segmented, 217.0 μ (176.0-324.0) long.

SPECIMENS EXAMINED – **Florida:** Alachua Co., Gainesville (VII-1-1970, *Feijoa sellowiana*, G. W. Dekle), 1 slide, 5 specimens (WG), (*Ilex cornuta* 'Burfordii', G. W. Dekle), 2 slides, 6 specimens (WG), (VII-2-1970, *Coffea arabica*, G. W. Dekle), 3 slides, 6 specimens (WG), (VII-7-1970, *Feijoa sellowiana*, G. W. Dekle), 1 slide, 3 specimens (WG); Dade Co., Hialeah (IX-6-1959, *Mangifera indica*, C. E. Stegmaier, Jr., at Miami), 1 slide, 4 specimens (USNM); Duval Co., Fort George (V-13-1880, *Prunus salicina*, R. S. Turner), 1 slide, 1 specimen (USNM), (V-17-1880, Lauraceae, R. S. Turner), I slide, 1 specimen (USNM), (*Persea borbonia*, collector unknown), 1 slide, 1 specimen (USNM), Jacksonville (I-17-1828, *Myrtus* sp., collector unknown), 1 slide, 6 specimens (USNM), (I-26-1880, *Mytrus* sp., J. H. Comstock), 1 slide, 5 specimens (USNM), Mandarin (VIII-2-1878, host unknown, L. H. Tallman), 2 slides, 3 specimens (USNM); Hernando Co., Brooksville (II-6-1923, *Eugenia* sp., W. B. Wood), 1 slide, 3 specimens (USNM); Hillsborough Co., Tampa (IV-7-1960, *Mangifera indica*, A. H. Forsyth), 1 slide, 5 specimens (USNM); Lake Co., Umatella (*II-23-1891, Diospyros kaka*, collector unknown), 1 slide, 1 specimen (USNM); Monroe Co., Key West (VI-6-1919, *Ficus* sp., H. L. Sanford), 1 slide, 2 specimens (USNM), Key West Sanctuary Garden (V-11-1960, host unknown, C. A. Bennett), 1 slide, 1 specimen (USNM); Putnam Co., Crescent City (VIII-17-1876, host unknown, collector unknown), 1 slide, 2 specimens (USNM); Co. unknown, Grahamsville (VIII-6-1889, *Citrus* sp., F. G. Lewis), 1 slide, 1 specimen (USNM), Green Coral Springs (III-29-1880, host unknown, R. S. Turner), 1 slide, 1 specimen (USNM), Lake Bearford (II-6-1880, *Punica* sp., J. H. Comstock), 1 slide, 1 specimen (USNM), Orange Heights (I-31-1889 *Cydonia* sp., C. Piernici), 1 slide, 1 specimen

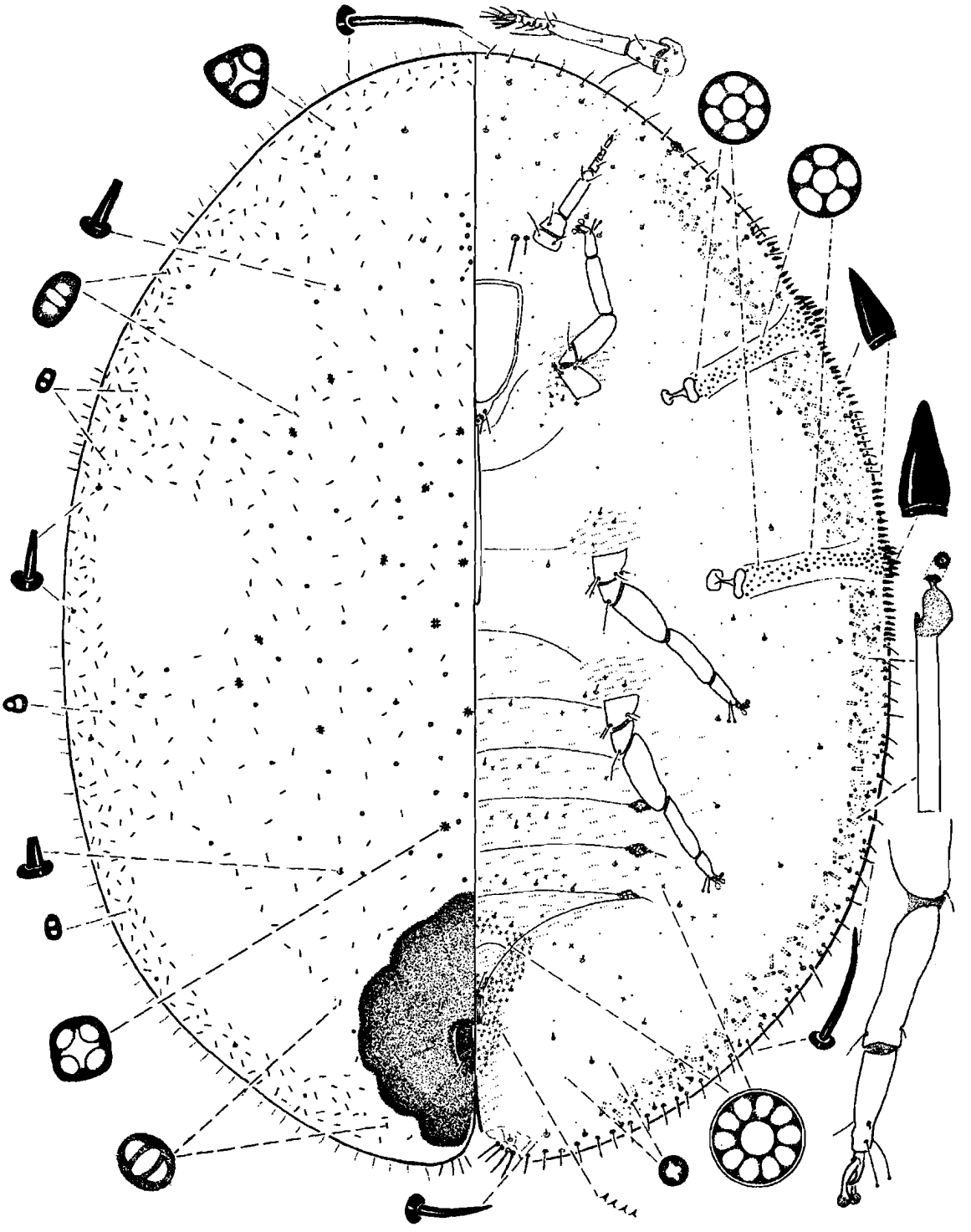


Figure 22. *Ceroplastes floridensis.* Slide mounted adult female. Georgia, Glynn Co., Brunswick (I-10-1917, *Cydonia* sp.).

(USNM), location unknown (III-1876, *Sarracenia minor*, Treat), 1 slide, 1 specimen (USNM), (date unknown, *Gardenia jasminoides*, collector unknown), 1 slide, 1 specimen (USNM), (*Myrtus* sp., collector unknown), 5 slides, 5 specimens (USNM), (*Persea borbonia*, collector unknown), 1 slide, 1 specimen (USNM), (Rosaceae, collector unknown), 1 slide, 1 specimen (USNM), (host unknown, collector unknown), 12 slides, 29 specimens (USNM).

Georgia: Glynn Co., Brunswick (I-10-1917, *Cydonia* sp., M. V. Richards), 1 slide, 4 specimens (USNM), (II-25-1936, *Vaccinium* sp., R. E. Benedict), 1 slide, 3 specimens (USNM), Jekyll Island (VI-18-1968, *Lindera benzoin*, J. A. Davidson), 1 slide, 1 specimen (UM); Tift Co., Tifton (XII-14-1960, host unknown, J. H. Girardaux, Jr.), 1 slide, 5 specimens (USNM).

Louisiana: East Baton Rouge Parish, Baton Rouge (III-20-1970, *Ilex vomitoria*, A. D. Oliver), 2 slides, 3 specimens (WG); Orleans Parish, New Orleans (VII-23-1914, *Laurus* sp., E. S. Tucker), 1 slide, 4 specimens (USNM), (XI-19-1959, *Ilex vomitoria*, W. T. Spink), 1 slide, 5 specimens (USNM).

Maryland: Baltimore Co., Baltimore (greenhouse) (X-30-1961, *Citrus mitis*, C. W. McComb), 1 slide, 3 specimens (USNM).

Mississippi: De Soto Co., Horn Island (I-1959, *Ilex vomitoria*, E. A. Richmond), 1 slide, 4 specimens (USNM).

Missouri: Independent City, St. Louis (1903, *Syzygium jambos*, collector unknown), 1 slide, 2 specimens (USNM).

New Mexico: Bernalillo Co., Alburqueque (II-2-1957, *Aralia* sp., Lucht), 1 slide, 3 specimens (USNM).

New York: Co. unknown, location unknown (XII-9-1935, host unknown, C. G. Latham, at Baltimore, Maryland), 1 slide, 3 specimens (USNM).

North Carolina: Carteret Co., Beaufort (VII-29-1919, *Ilex vomitoria*, O. W. Hyman), 1 slide, 5 specimens (USNM).

Texas: Harris Co., Houston (III-1972, *Ilex crenata*, R. M. Altman), 6 slides, 6 specimens (MSBA, USNM).

Virginia: Goochland Co., Goochland (VII-8-1960, *Pernettya* sp., F. R. Freund), 2 slides, 2 specimens (USNM).

Washington, D. C.: (IV-11-1919, host unknown, P. R. Lowry), 2 slides, 6 specimens (USNM).

FOREIGN SPECIMENS EXAMINED – **Bermuda:** location unknown (II-4-1932, *Fortunella japonica*, C. A. Davis, at Boston), 2 slides, 2 specimens (USNM), (*Laurus nobilis*, C. A. Davis, at Boston), 1 slide, 2 specimens (USNM).

British Honduras: Belize (IX-1959, *Mangifera indica*, N. L. H. Krauss), 1 slide, 4 specimens (USNM).

Curacao: Location unknown (VI-22-1959, *Gardenia* sp., M. A Fischetti, at New York) 1 slide, 1 specimen (UNSM).

Ecuador: Manabi Province, Portoviejo (VIII-29-1959, *Platanus* sp., G. Merino), 1 slide, 4 specimens (USNM); Pichincha Province, Santo Domingo, (IV-11-1959, *Coffea* sp., J. G. Donoso), 1 slide, 4 specimens (USNM); province unknown, Pallatanga (XII-18-1958, *Citrus* sp., G. Merino), 1 slide, 5 specimens (USNM).

Hong Kong: (XI-20-1958, *Rhodomyrtus tomentosa*, N. L. H. Krauss), 1 slide, 5 specimens (USNM).

Mexico: State unknown, location unknown (II-24-1936, *Gardenia* sp., E. P. Reagan, at Brownsville, Texas), 1 slide, 1 specimen (USNM). (XII-8-1936, *Gardenia* sp., Singleton, Callaghan, at Brownsville, Texas), 1 slide, 3 specimens (USNM), (I-11-1959, *Eriobotrya japonica*, Bixby, Johnson), 1 slide, 1 specimen (USNM).

Montserrat: (X-5-1936, host unknown, McMaster, at New York, New York), 1 slide, 3 specimens (USNM).

Nicaragua: Carazo, San Marcos (X-23-1959, *Citrus* sp., M. Vaughan), 1 slide, 2 specimens (USNM).

Puerto Rico: Fort Buchanan (II-21-1959, *Persea americana*, H. K. Plank), 1 slide, 4 specimens (USNM), San Juan (I-1899, *Aralia* sp., A. Busck), 1 slide, 2 specimens (USNM), (*Psidium pomiferum*, A. Busck), 2 slides, 2 specimens (USNM).

Trinidad: location unknown (VIII-1-1959, *Persea americana*, G. W. Miskaimen), 1 slide, 3 specimens (USNM).

HOSTS AND DISTRIBUTION – *C. floridensis* was first collected in the U.S. in Florida in 1828. Comstock (1881) felt that it was native to Florida, although Cockerell (1895) suggested that it was native to the West Indies. We agree that this species is native to this general area. In the U.S. it occurs throughout the southeast, as far west as New Mexico (greenhouse infestation?), and has been recorded as far north as Maryland and Washington, D. C., where it overwinters only in greenhouses. Outside of the U. S. this species is widespread.

In the U.S. it occurs on about 25 host plants some of which are non-cultivated such as gall berry (*Ilex glabra*). According to Ben-Dov (1970), there are 70 recorded hosts in Israel. Preferred hosts in the U. S. are *Ilex, Citrus, Laurus, Ficus, Psidium,* and *Nerium*.

ECONOMIC IMPORTANCE – *C. floridensis* is an economic pest of many ornamental trees and shrubs throughout its distribution in the U. S. Since it has been recorded on *Citrus*, economic entomologists should be aware of its potential as a pest on this crop. In dense populations large quantities of honeydew are secreted which provide a medium for sooty mold fungi and give the foliage an unsightly appearance. The build-up of fungus reduces the amount of photosynthesis, may cause leaf drop, and thus contributes to a decline in plant vigor.

BIOLOGY – Only biological characteristics of apparent taxonomic importance are given here; a more detailed biological treatment will be presented in a future paper. All instars of *floridensis* are found on the stems, branches, and leaves of their hosts and do not migrate from 1 area of the host to another. Individual wax tests remain distinct even in dense populations. Males have not been recorded for this species.

DISCUSSION – *C. floridensis* is characterized as follows: without a mediodorsal clear area; dorsal setae predominantly cylindrical, with truncate apices; with 1 ventral seta on each anal plate; with an unusually large number of marginal bristle-shaped setae, about 67 on each margin; with about 28 stigmatic setae laterad of

each stigmatic furrow which are lanceolate with pointed apices; without filamentous ducts; multilocular pores present on all abdominal segments, normally also present near each coxa; tubular ducts each with inner filament expanded, present along ventral submargin from just below eye to slightly anterior of anal cleft; legs without tibiotarsal scleroses, with equal claw digitules; antennae normally 6-segmented.

Of the foreign species examined, *japonica* Green most nearly resembles *floridensis*. *C. japonica* differs in possessing a continuous row of stigmatic setae in the interfurrow space; whereas, *floridensis* possesses a section of the interfurrow margin which is devoid of stigmatic setae.

In the U.S., *floridensis* can be separated from all other species of *Ceroplastes* in possessing: tubular ducts with a greatly expanded inner filament; tubular ducts in a ventral submarginal band extending from near the eye to slightly anterior of the anal cleft; no mediodorsal clear area.

Ceroplastes irregularis Cockerell
Suggested Common Name: Desert Wax Scale
Figure 5(2), 7(1), 23, 24

Ceroplastes irregularis Cockerell, 1893a, p. 351.
Ceroplastes irregularis var. *rubidus* Cockerell, 1896c, p. 203 [New synonymy].

TYPE DATA – The type locality is 6 miles north of Montezuma Railroad Station, state of Chichuahua, Mexico. There is some question as to the type host; Cockerell in the original description indicates *Artemisia* sp., but says he thinks this was a misidentification of *Sarcobatus* sp. Cockerell did not designate a holotype in his original description of this species. Two slide mounted adult females labeled "TYPE" are deposited in the USNM. One label reads "*Ceroplastes irregularis* Ckll. Type On *Atriplex* 6. mi N. of Montezuma Chihuahua, Mexico May 1893 Ckll. [Collection] Coccidae 102 5757." The label from the other slide reads, "*Ceroplastes irregularis* Ckll Type. 6 mi. N. of Montezuma Chihuahua, Mexico May 1893 ex Ckll. Coll [Collection]." Two boxes of dry unmounted material which correspond to the 2 "TYPE" specimens are also deposited in the USNM. Notes in each of these boxes indicate the specimens were collected 6 miles north of Montezuma, Chihuahua, Mexico, May 1893. Although the data on these specimens does not exactly fit the data given by Cockerell (1893a), there is little doubt that it is part of the type series, since it is from the same locality as mentioned in the original description. From these syntypes we have chosen the specimen (1 specimen on 1 slide) labeled as from *Atriplex* (which probably is the correct name of the type host) as the lectotype. The remaining syntypes are labeled as paralectotypes. The lectotype and paralectotypes are deposited in the USNM.

We have examined syntype material of *irregularis* var. *rubidus* and consider this "variety" to be a junior synonym of *irregularis*.

FIELD CHARACTERS – The following description is based on fresh material.

Test: wet wax highly variable, round or oval in some specimens to irregular in others, often with crown of 5 irregular white nodules sometimes covered with white wax sometimes wax dark brown rarely wax with yellow tinge, normally hemispherical in lateral view, without horn, with small marginal flange not hiding lateral filaments, without plates and nuclei. Dry wax with filaments as follows: cephalic filament appearing trifurcate, with acute apices; anterolateral, mediolateral, and posterolateral filaments simple; dorsal dry wax of first and second instars forming central cap, not surrounded by nucleus; dorsal dry wax not tilted. Stigmatic wax bands present near anterior pair of spiracles only, anterior bands directed dorsally, filamentous wax confined to anterior stigmatic areas. Length 5.0 mm (1.5-8.4), width 4.0 mm (1.0-7.0), height 3.2 mm (1.0-5.0).

Body: oval, light brown; anal process short.

The field characters of this species are extremely variable.

SLIDE MOUNTED CHARACTERS – Adult female elliptical, length 3.0 mm (1.3-5.6), width 2.3 mm (0.8-5.2).

Dorsum: membranous in young adult females, slightly sclerotized in older adult females; with 1 cephalic, 1 mediodorsal, and 6 lateral clear areas devoid

of pores and setae, except cephalic area with 2-4 cylindrical setae; dorsal setae variable (fig. 7(1)), about 65 cylindrical setae with blunt to pointed apices, 4.4 μ (2.5-6.5) long. Dorsal pores distributed as follows: about 50 bilocular pores concentrated on submargin; about 220 oval trilocular pores evenly distributed, triangular trilocular pores variable 300 (30-550), evenly distributed; quadrilocular pores variable 28 (5-50), located in mesal area; about 5 quinquelocular pores. Tubular ducts absent. Anal plates each with 1 ventral and 4 dorsal setae.

Margin: marginal bristle-shaped setae 14.4 μ (10.4-25.0) long (ventral submarginal setae are occasionally as long as the marginal setae, therefore, they may be confused with one another, see page 13 for further discussion), placed as follows: 6.0 (5.0-7.0) between eye tubercles, 3.0 (2.0-4.0) between each eye tubercle and anterior stigmatic furrow, 15.0 (14.0-16.0) between each anterior stigmatic furrow and anal cleft, last 3 or 4 thicker, longer, 18.2 μ (17.4-29.0), in cluster on anal lobes; stigmatic setae hemispherical to triangular with rounded apices (fig. 5(2)), length 1.0 to 1.5 times greater than width at base, 39.2 (19.0-74.0) laterad of each anterior stigmatic furrow, absent in posterior stigmatic furrows, in 4-6 irregular rows, length from 5.8-12.6 μ long. Filamentous ducts absent.

Venter: membranous; bristle-shaped setae normally of 1 size, (sometimes with submarginal setae larger than remaining ventral setae) placed as follows: 18.0 (16.0-21.0) on each submargin, 8.1 μ (5.2-10.4) long, 2.0 (1.0-4.0) associated with each coxa, 4.0 (3.0-6.0) in cephalic region, 4.0 (1.0-12.0) on each abdominal and thoracic segment; interantennal space with 1 pair of lateral bristle-shaped setae 21.8 μ (13.1-24.6) long, 1 pair of mesal bristle-shaped setae 28.2 μ (16.8-33.0) long, 1 pair of mesal bristle-shaped setae 23.2 μ (21.8-30.5) long on segment 8 anterior to vulva, surrounded by 1-3 pairs of short bristle-shaped setae 6.9 μ (5.2-9.2) long. About 350 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous toward meson; 80.0 (50.0-100.0) stigmatic pores in irregular band in each anterior stigmatic furrow, extending from spiracular atrium to stigmatic setae; 33.0 (21.0-42.0) in each posterior stigmatic furrow, in cluster laterad of spiracular atrium, most furrows predominantly with quinquelocular pores, nearly always with several pores with more than 5 loculi; about 275 multilocular pores

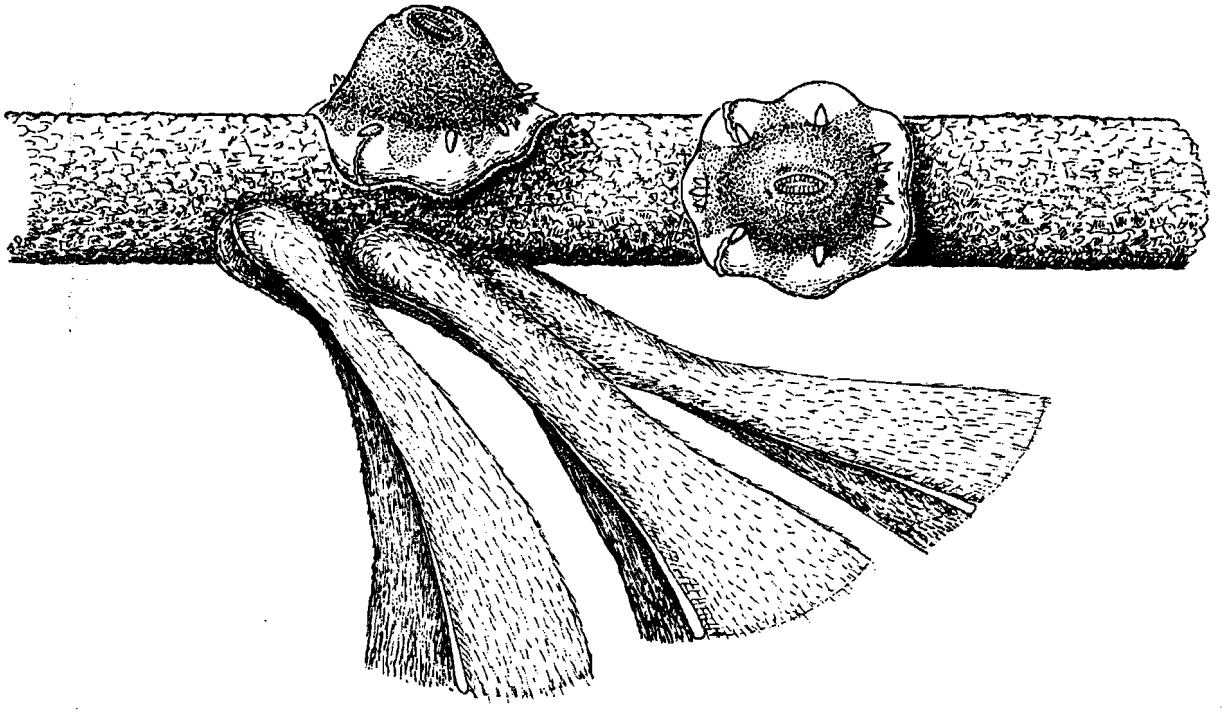


Figure 23. *Ceroplastes irregularis.* Wax test old adult female. Texas, Hutchinson Co., Borger (VII-1972, *Artemisia* sp.).

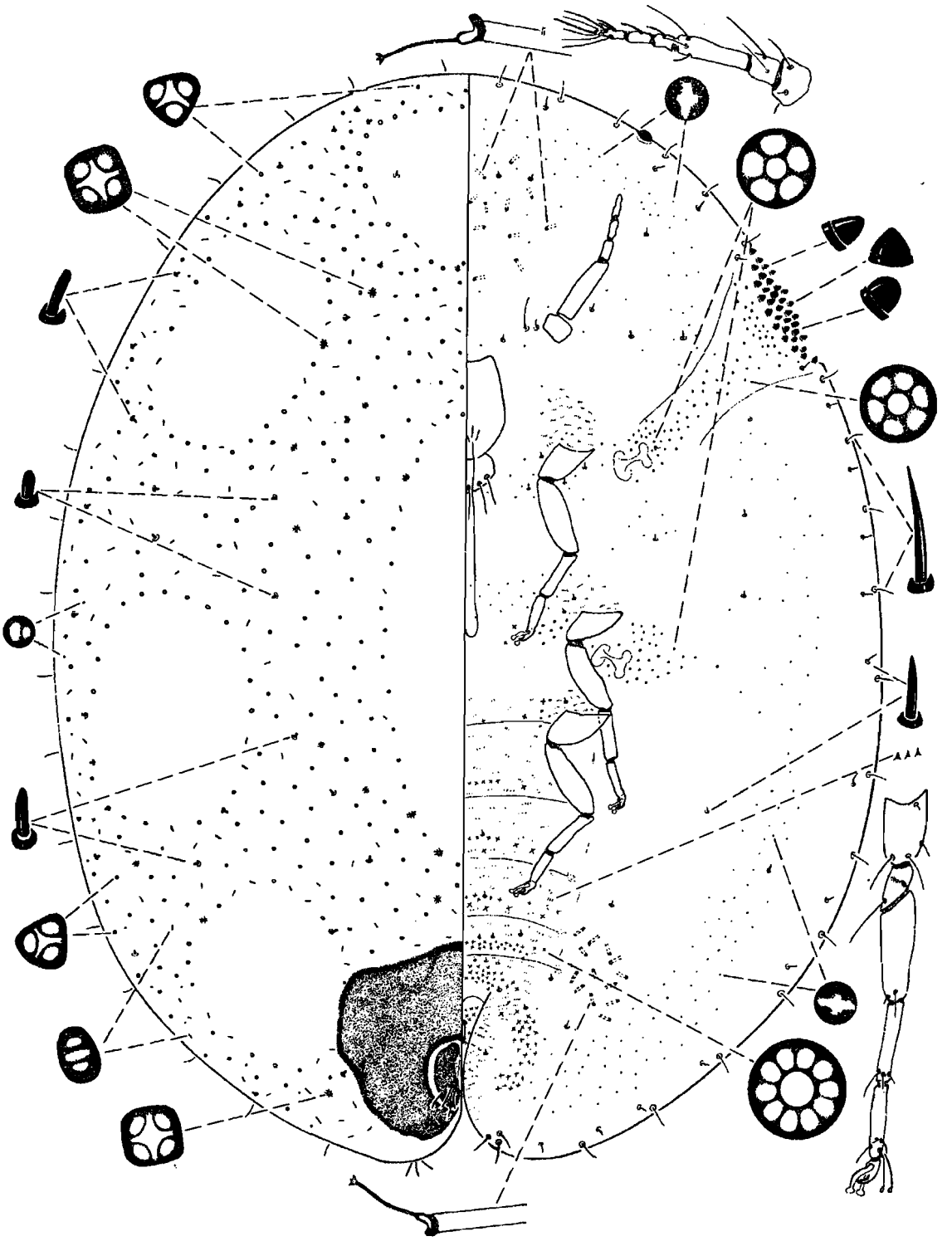


Figure 24. *Ceroplastes irregularis.* Slide mounted adult female. Nevada, Churchill Co., 60 mi. NE Sparks, near Jessup (VII-3-1970, *Atriplex* sp.).

surround vulva, 90.0 (85.0-113.0) on seventh abdominal segment, 12.0 (2.0-24.0) on each preceding abdominal segment, 1.0 (0.0-10.0) near base of each coxa, several of these pores near coxae with fewer than 10 loculi. Tubular ducts with slightly asymmetrical cups, each duct with inner filament nearly as long and much narrower than basal part of duct, arranged in 2 clusters as follows: 20.0 (12.0-56.0) in cephalic region; 23.0 (10.0-50.0) in region of vulva. Legs 327.0 μ (290.0-387.0) long; tibia without basal setae, tibia less than 2 times length of tarsus, with tibiotarsal scleroses; tarsal digitules 36.6 μ (32.6-43.7) long; with equal claw digitules 19.7 μ (18.2-23.4) long; claws with small denticles; length of leg segments as follows: coxa 49.4 μ (43.7-65.6), trochanter plus femur 127.3 μ (103.2-130.1), tibia 77.0 μ (65.5-98.9), tarsus 62.3 μ (49.6-87.2), claw 20.6 μ (17.4-26.1) long. Antennae 6- or 7-segmented, 218.3 μ (195.0-249.8) long.

SPECIMENS EXAMINED – **Arizona:** Pima Co., 10 mi. E. Tucson (III-21-1968, *Atriplex* sp., D. R. Miller, D. S. Horning), 1 slide, 2 specimens (UCD).

California: Riverside Co., San Jacinto (VHI-4-1906, *Atriplex* sp., S. A. Pease), 1 slide, 5 specimens (USNM), (1910, *Atriplex* sp., collector unknown), 6 slides, 7 specimens (UM); San Diego Co., Cardiff By the Sea (I-25-1971, *Atriplex* sp., E. L. Paddock), 1 slide, 2 specimens (WG).

Idaho: Gooding Co., 7 mi. down Snake River from Bliss (XII-1948, *Artemisia* sp., W. F. Barr), 1 slide, 8 specimens (USNM); Owyhee Co., Grandview (III-25-1955, *Atriplex* sp., W. F. Barr), 1 slide, 4 specimens (USNM).

Nevada: Churchill Co., 60 mi. NE. of Sparks, near Jessup (VIII-3-1970, *Atriplex* sp., D. R. Miller), 3 slides, 7 specimens (USNM); Lincoln Co., 55 mi. NW. of Alamo (VII-5-1970, *Eurotia lanata*, D. R. Miller), 1 slide, 1 specimen (USNM); Nye Co., 2 mi. E. of Tonopah (VII-7-1968, *Atriplex* sp., D. R. Miller, R. F. Denno), 1 slide, 1 specimen (UCD); Washoe Co., Wadsworth (V-5-1904, *Chrysothamnus* sp., P. Beveridge, Kennedy), 1 slide, 5 specimens (USNM).

New Mexico: Bernalillo Co., Isleta (XI-10-1968, *Atriplex canescens*, H. W. Springfield), 2 slides, 5 specimens (USNM); Grant Co., Silver City (I-20-1881, *Artemisia* sp., H. H. Busby), 5 slides, 5 specimens (USNM); Otero Co., 20 mi. SW. Alamogordo, (VIII-10-1944, *Atriplex canescens*, J. H. Russell), 2 slides, 5 specimens (USNM); Co. unknown, Lunar Well (IX-30-1896, *Atriplex canescens*, C. H. T. Townsend), 2 slides, 3 specimens (USNM), location unknown (IX-17-1951, *Atriplex canescens* J. H. Russell), 1 slide, 3 specimens (USNM).

Texas: El Paso Co., El Paso (III-24-1944, host unknown, E. Smith, Stromberg), 1 slide, 3 specimens (USNM).

FOREIGN SPECIMENS EXAMINED – **Mexico: Chihuahua,** 6 mi. N. Montezuma (V-1893, *Atriplex* sp., collector unknown), 2 slides, 2 specimens (USNM).

HOSTS AND DISTRIBUTION – Based on our records, *irregularis* was first collected in the U.S. in New Mexico in 1881. This species is apparently native to Mexico and the western U.S. and to our knowledge does not occur outside this area. In the U.S., it probably occurs throughout the Great Basin, the desert areas of the southwestern U.S., and along the coast of southern California.

The host list is limited, including only 2 host families. The preferred host is *Atriplex*.

ECONOMIC IMPORTANCE – *C. irregularis* is of no apparent economic importance.

BIOLOGY – Only biological characteristics of apparent taxonomic importance are given. All instars of *irregularis* are found on the stems or branches of their hosts and do not migrate from 1 area of the host to another. In heavy infestations, individual wax tests tend to fuse together sometimes completely surrounding infested branches. Males have not been recorded for this species.

DISCUSSION – *C. irregularis* is the only known species of *Ceroplastes* that lacks stigmatic setae laterad of the posterior stigmatic furrows. This character at once separates it from all other species of *Ceroplastes*.

Ceroplastes nakaharai Gimpel, new species
Suggested Common Name: Nakahara Wax Scale
Figure 5(3), 7(2), 25, 26, 27

TYPE DATA – I here designate as holotype the right-hand specimen of 2 adult females on 1 slide labeled as follows: "Holotype *Ceroplastes nakaharai* right-hand specimen DET. W. F. GIMPEL," and "Florida Dade Co. U. of Miami Arboretum XII-6-1970, Ex. *Coccolobis diversifolia* S. Nakahara col. N.F. 39 Balsam." I also designate 24 adult female paratypes.

The holotype and several paratypes are deposited in the USNM. Additional paratypes are deposited in the following institutions: BM, CDA, CSIRO, FSCA, MNC, MNHN, PPRI, TAES, UCD, UH, UM, VPI, WG, ZAS.

I name this species in honor of Mr. Sueo Nakahara who not only collected this and several other species of wax scales, but who also gave valuable suggestions in the preparation of this manuscript.

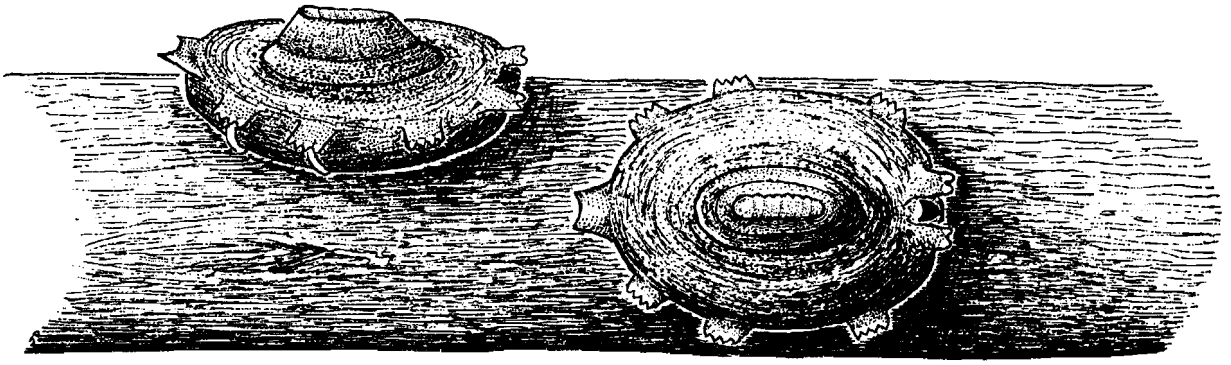


Figure 25. *Ceroplastes nakaharai.* Wax test young adult female. Maryland, Prince Georges Co., College Park, University greenhouse (V-12-1972, *Ilex cornuta* 'Burfordii').

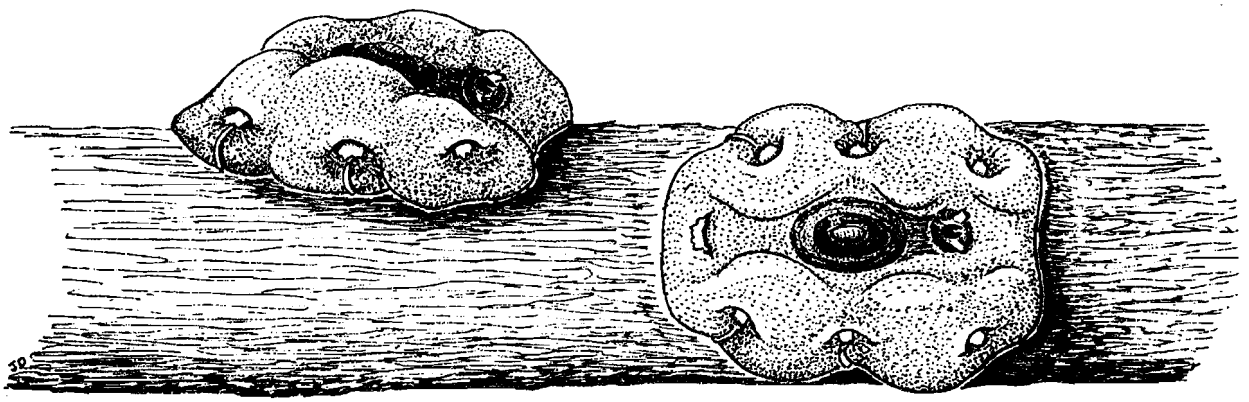


Figure 26. *Ceroplastes nakaharai.* Wax test old adult female. Florida. Dade Co., Miami (VII-28-1972, *Coccolobis floridana).*

FIELD CHARACTERS – The following description is based on fresh material.

Test: wet wax oval in young females, rectangular in old specimens in dorsal view, nearly flat laterally, without horn, yellowish, without marginal flange, plates, and nuclei. Dry wax with filaments as follows: cephalic filament simple, unusually broad, smooth apically on young females, fringed apically on old females; anterolateral, mediolateral, and posterolateral filaments unusually broad, apically fringed; caudal filaments bifurcate or fringed; dorsal dry wax of first and second instars forming central ridge on young females, present in center of longitudinal groove in older material, not surrounded by nucleus; dorsal dry wax not tilted. Stigmatic wax bands present near both pairs of spiracles, anterior bands directed dorsally, filamentous wax confined to stigmatic areas. Length 5.0 mm (2.0-7.1), width 4.8 mm (1.0-6.3), height 2.3 mm (0.7-4.1).

Body: oval, dark purplish brown; anal process short, extending forward in older adult females to mesothorax.

SLIDE MOUNTED CHARACTERS – Adult female holotype oval, length 1.5 mm, width 1.1 mm.

Dorsum: membranous; with 1 cephalic, 1 mediodorsal, and 6 lateral clear areas with conspicuous primary wax pores, devoid of other pores and setae, except cephalic area with 2 cylindrical setae and mediodorsal area which possesses numerous cylindrical setae; dorsal setae variable (fig. 7(2)), about 280 cylindrical setae with pointed, obliquely truncate, or slightly expanded apices, 5.9 μ (4.4-8.7) long. Dorsal pores distributed as follows: about 1200 bilocular pores evenly distributed; about 450 irregular oval trilocular pores evenly distributed, 7 triangular trilocular pores normally present near submargin; 1 quadrilocular pore near spiracular setae; quinquelocular pores absent. Tubular ducts absent. Anal plates each with 3 ventral and 4 dorsal setae.

Margin: marginal bristle-shaped setae 19.5 μ (17.3-29.1) long, (ventral submarginal setae are often as long as the marginal setae, therefore, they may be confused one with the other, see page 13 for further discussion), placed as follows: 6.0 between eye tubercles, 2.0 between each eye tubercle and each anterior stigmatic furrow, 3.0 between each anterior and posterior stigmatic furrow, 10.0 between each posterior stigmatic furrow and anal cleft, last 3 thicker, longer, 24.0 μ (21.8-37.1), in cluster on anal lobes; stigmatic setae cylindrical or barrel-shaped, with smooth or wrinkled truncate apices (fig. 5(3)), length 1.0-1.5 times greater than width at base, 7.0 (6.0-9.0) laterad of each stigmatic furrow in 2-3 irregular rows, length 7.8-9.3 μ long. Filamentous ducts absent. Eye tubercles protruding a distance equal to their width.

Venter: membranous; bristle-shaped setae of 2 sizes, those on submargin 20.6 μ (12.7-19.9) long, placed as follows: 18 between eye tubercles, 6 between each eye tubercle and each anterior stigmatic furrow, 7 between each anterior and posterior stigmatic furrow, 23 between each posterior stigmatic furrow and anal cleft; shorter bristle-shaped setae 6.4 μ (4.4-11.6) long, placed as follows: 2-4 associated with each coxa, 6 in cephalic region, 4 on each abdominal and thoracic segment; interantennal space with 1 pair of bristle-shaped setae 29.0 μ long; 1 pair of mesal bristle-shaped setae on segment 8 anterior to vulva obscured by anal ring, surrounded by 3 pairs of short bristle-shaped setae 7.8 μ (6.1-11.6) long. About 600 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous towards meson; 67.0 (60.0-75.0) stigmatic pores in irregular band in each stigmatic furrow, extending from spiracular atrium to stigmatic setae, most furrows predominantly with quinquelocular pores, nearly always with several pores with more than 5 loculi; about 380 multilocular pores surround vulva, about 170 on seventh abdominal segment, about 33 on sixth abdominal segment, 6 on fifth abdominal segment, absent on preceding abdominal and thoracic segments. Tubular ducts with slightly asymmetrical cups, each duct with inner filament nearly as long and much narrower than basal part of duct, arranged in 2 clusters as follows: 16 in cephalic region; 30 in region of vulva and on anterior abdominal segments. Legs 320.0 μ (295.0-340.0) long, prothoracic and mesothoracic legs slightly longer than metathoracic legs; tibia without basal setae; prothoracic tibiae more than twice the length of the prothoracic tarsi, without tibiotarsal scleroses; tarsal digitules about 35.0 μ long; with unequal claw digitules about 32.0 μ long; claws with small denticles; length of leg segments as follows: coxa 43.7 μ, trochanter plus femur 132.0 μ, tibia 76.5 μ, tarsus 34.0 μ, claw 15.2 μ long. Antennae 6-segmented, 240.0 μ long, often displaying poor segmentation.

Variation – Slide mounted specimens are generally larger than the holotype, length 3.0 mm (1.0-5.9), width 2.2 mm (1.0-5.7). On the dorsum, several cylindrical setae with subacute apices located in the mesal area reach a length of about 13.5 μ; bilocular pores variable in number from 400-1300; triangular trilocular pores variable in number from 1-25; marginal bristle-shaped

setae are normally longer than those on the holotype with several attaining a length of about 32.0 μ, the last 3 up to 56.0 μ. Several specimens had more stigmatic setae in each stigmatic furrow area than normal. The numbers of these setae varied from 5-12. The interantennal space of most specimens had one pair of lateral bristle-shaped setae 13.1 μ (10.9-26.1) long, and 1 pair of mesal bristle-shaped setae 54.6 μ (24.0-97.0) long. The mesal bristle-shaped setae on segment 8 anterior of the vulva were usually 54.0 μ (43.5-67.7) long. The number of stigmatic pores in each stigmatic furrow varies from 40-95. Multilocular pores are normally more numerous on the sixth and fifth abdominal segments, up to 70 on sixth, 20 on fifth, occasionally 1-4 on the fourth abdominal segment. Tubular ducts normally more numerous, 25-35 in region of vulva. Legs are normally longer than the holotype. Measurements from 10 paratypes are as follows: legs 306.0 μ (253.0-358.0) long, coxa 49.1 μ (43.7-54.2) long, trochanter plus femur 130.1 μ (113.7-144.0) long, tibia 89.2 μ (73.5-104.2) long, tarsus 35.0 μ (32.7-39.3). Antennae are also normally longer than those on the holotype, with measurements from 10 paratypes as follows: 248.7 μ (228.0-273.0) long. Since the holotype is a young adult female the anal process is not yet produced. In paratypes represented by older adult females the base of the anal process normally extends anteriorly to the mesothorax.

SPECIMENS EXAMINED – **Florida:** Broward Co., Fort Lauderdale (IV-21-1961, *Ixora acuminata*, J. M. Sooval), 1 slide, 4 paratype specimens (USNM); Dade Co., Miami (VI-6-1923, *Coccolobis floridana*, R. Hart), 1 slide, 1 paratype specimen (USNM), (IV-3-1933, *Coccolobis* sp., D. H. Blake), 1 slide, 3 paratype specimens (USNM), (II-24-1953, *Coccolobis floridana*, collector unknown), 2 slides, 4 paratype specimens (USNM), Miami (XII-6-1970, *Coccolobis diversifolia*, S. Nakahara), 3 slides, 1 holotype and 5 paratype specimens (USNM); Lake Co., Tavares (X-5-1970, *Phoradendron flavescens*, H. T. Davis), 15 slides, 15 paratype specimens (BM, CDA, CSIRO, FSCA, MNC, MNHN, PPRI, TAES, UCD, UH, UM, VPI, WG, ZAS); Palm Beach Co., Palm Beach (V-14-1895, *Coccolobis floridana*, A. H. Curtis), 1 slide, 1 paratype specimen (USNM); Polk Co., Frostproof (II-13-1918, Loranthaceae, W. C. Nanney), 1 slide, 2 paratype specimens (USNM).

FOREIGN SPECIMENS EXAMINED – **Cuba:** Havana (I-26-1921, *Tamarix* sp., C. H. Ballou), 4 slides, 4 specimens (USNM, FSCA).

HOSTS AND DISTRIBUTION – Based on our records, *nakaharai* was first collected in Florida in 1895 and was identified as *Ceroplastes* sp. In the U.S., it is now known only from Florida, although it probably also occurs in the southern states along the Gulf of Mexico and in southern Georgia. Outside of the U.S. it occurs in Cuba and will probably be found in other parts of the Greater Antilles.

The host list of this species is limited to 3 plant genera. The preferred hosts seem to be *Phoradendron* and *Coccolobis*.

ECONOMIC IMPORTANCE – *C. nakaharai* is of no apparent economic importance.

BIOLOGY – Only biological characteristics of apparent taxonomic importance are given here; a more detailed biological treatment will be presented in a future paper. All instars of *nakaharai* are found on the stems or branches of their hosts and do not migrate from 1 area of the host to another. In heavy infestations individual wax tests remain distinct, although not as distinct as on *cirripediformis* or *sinensis*. Males of this species have not been found.

DISCUSSION – *C. nakaharai* is characterized as follows: mediodorsal clear area with several dorsal setae; dorsal setae predominantly with pointed apices; with bilocular pores most numerous of dorsal pores; with 3 ventral setae on each anal plate; with sclerotization of anal process truncate anteriorly, extending forward to mesothorax on older adult females; with about 7 stigmatic setae laterad of each stigmatic furrow which are cylindrical or barrel-shaped with smooth or wrinkled truncate apices; without filamentous ducts; with ventral submarginal row of bristle-shaped setae nearly as long as marginal setae; multilocular pores present on abdominal segments 6-8; legs without tibiotarsal scleroses, with unequal claw digitules, with small claw denticle; antennae 6-segmented.

Of the foreign species examined, *adustus* De Lotto and *marmoreus* most nearly resemble *nakaharai*. *C. adustus* differs as follows: mediodorsal clear area without dorsal setae; stigmatic setae with rounded apices; with sclerotization of anal process rounded anteriorly, restricted to abdomen on older adult females; with ventral submarginal setae distinctly shorter than marginal setae; without tubular ducts in cephalic region. Whereas, *nakaharai* possesses: mediodorsal clear area with several dorsal setae; stigmatic setae with truncate apices; sclerotization of anal process truncate anteriorly, extending forward to mesothorax on older adult females; ventral submarginal setae nearly as long as marginal setae; tubular ducts in cephalic region. *C. marmoreus* differs as follows: mediodorsal clear area without setae; stigmatic setae equilateral, with pointed apices; with 1 ventral seta on each anal plate; with

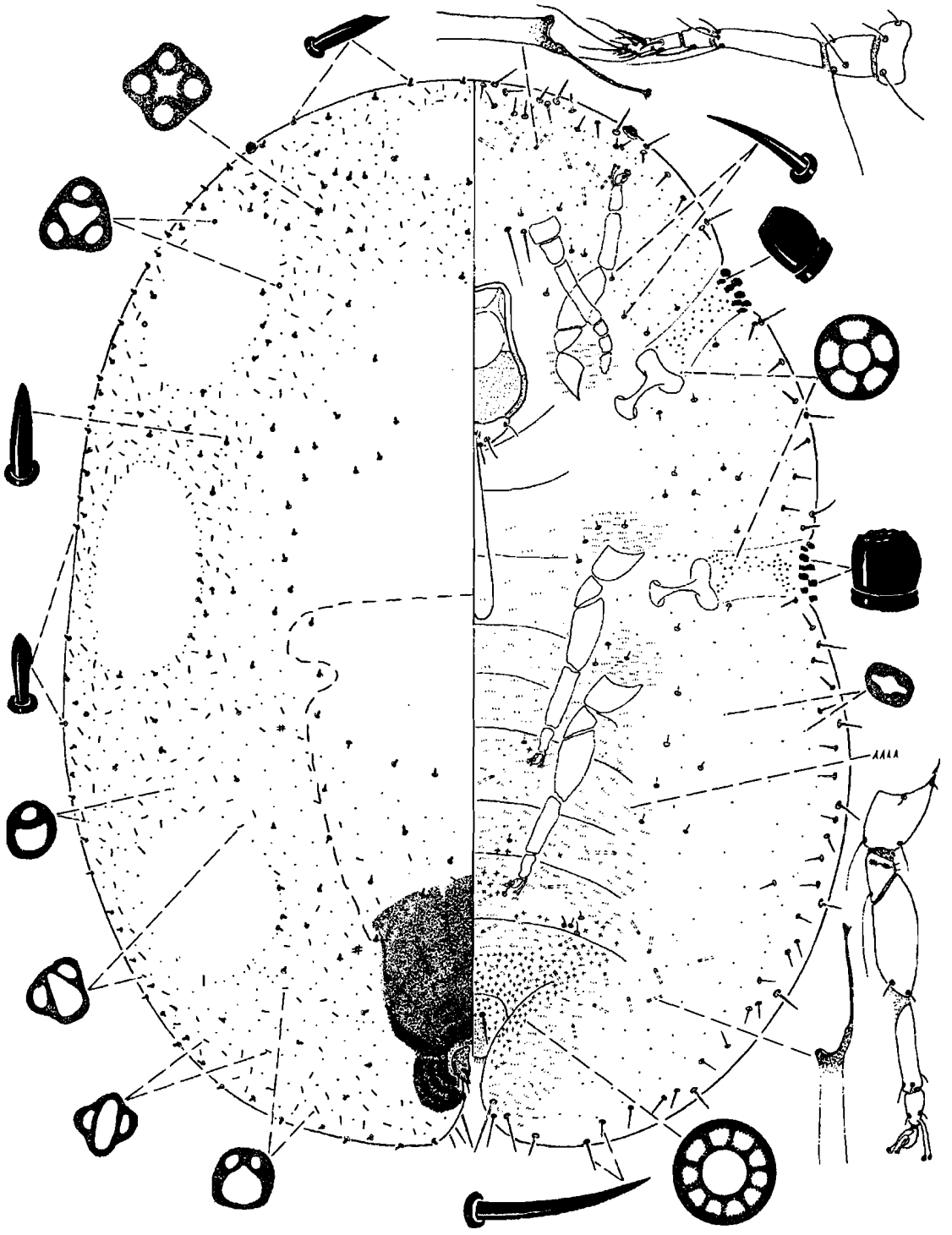


Figure 27. *Ceroplastes nakaharai.* Slide mounted adult female. Florida, Dade Co., Miami (XII-6-1970, *Coccoloбis diversifolia).*

sclerotization of anal process rounded anteriorly, restricted to abdomen on older adult females. Whereas, *nakaharai* possesses: mediodorsal clear area with several dorsal setae; cylindrical or barrel-shaped stigmatic setae, with truncate apices; 3 ventral setae on each anal plate; sclerotization of anal process truncate anteriorly, extending forward to mesothorax on older adult females.

In the U. S., *utilis* most nearly resembles *nakaharai*. *C. utilis* differs as follows: with 1 ventral seta on each anal plate; with from 18-32 stigmatic setae laterad of each stigmatic furrow; mediodorsal clear area without setae; with sclerotization of anal process rounded anteriorly, not extending to thorax on older adult females, with legs varying from 229-294 μ long; with oval trilocular pores most abundant pore type on dorsum. Whereas, *nakaharai* possesses: 3 ventral setae on each anal plate; from 5-12 stigmatic setae laterad of each stigmatic furrow; mediodorsal clear area with several setae; sclerotization of anal process truncate anteriorly, extending forward to thorax on older adult females; legs varying from 295-340 μ long; with bilocular pores most abundant pore type on dorsum.

The senior author alone is responsible for the description of this new species.

Ceroplastes rubens Maskell
ESA Approved Common Name: Red Wax Scale
Figure 5(4), 7(3), 28, 29

Ceroplastes rubens Maskell, 1893, p. 214.
Ceroplastes rubens var. *minor* Maskell, 1897, p. 309.
Ceroplastes myricae (Linnaeus); Green, 1900, p. 8 [Misidentification].

TYPE DATA – The type locality is Brisbane, Australia. *Mangifera indica* and *Ficus (F. macrophylla?)* are reported as the type hosts. We have not seen type material of *rubens*, however this species is well known and there is little question as to its identity.

FIELD CHARACTERS – The following description is based on dry material.

Test: wet wax pentagonal in dorsal view, hemispherical laterally, without horn, pink to reddish brown, with marginal flange, not hiding lateral filaments, without plates and nuclei. Dry wax with filaments as follows: cephalic filament simple, apically acute; anterolateral and posterolateral filaments simple; mediolateral filaments apparently absent; caudal filaments simple; dorsal dry wax of first and second instars apparently absent, indicated only by small depression in wet wax. Stigmatic wax bands present near both pairs of spiracles, anterior bands directed forward, nearly touching anteriorly, filamentous wax confined to stigmatic areas. Length 3.5 mm (2.0-5.0), width 3.0 mm (2.5-4.0), height 2.0 mm (1.5-3.5).

Body: elliptical, brown; anal process short.

SLIDE MOUNTED CHARACTERS – Adult female elliptical, length 2.0 mm (1.0-4.5), width 1.5 mm (0.8-3.0).

Dorsum: membranous in young adult females, slightly sclerotized in older adult females; with 1 cephalic, 1 mediodorsal, and 6 lateral clear areas devoid of pores and setae except cephalic area which possesses 4 cylindrical setae and mediodorsal area which possesses numerous cylindrical setae; dorsal setae variable (fig. 7(3)), about 175 cylindrical or conical setae with truncate apices, 3.8 μ (3.0-4.6) long. Dorsal pores distributed as follows: about 1700 bilocular pores evenly distributed; about 100 irregular oval trilocular pores evenly distributed, triangular trilocular pores absent; quadrilocular pores absent; quinquelocular pores absent. About 200 tubular ducts (fig. 29) evenly distributed. Anal plates each with 1 ventral and 4 dorsal setae.

Margin: marginal bristle-shaped setae confined to lobes of anal cleft, 26.5 μ (17.4-40.6) long, in clusters; stigmatic setae predominantly hemispherical, large seta of outer row bullet-shaped with expanded base (fig. 5(4)), 30.0 (24.0-35.0) laterad of each stigmatic furrow in 3 or 4 irregular rows, length from 5.8-49.8 μ long. Filamentous ducts absent. Eye tubercles not discernable.

Venter: membranous; bristle-shaped setae placed as follows: 30.0 (24.0-33.0) on each submargin, 5.8 μ (4.6-8.1) long, 3.0 (2.0-6.0) associated with each coxa, 38.0 (32.0-51.0) in cephalic region, 6.0 (1.0-14.0) on each abdominal and thoracic segment; interantennal space with 2 or 3 pairs of bristle-shaped setae 40.0 μ (22.0-58.0) long; 1 pair of mesal bristle-shaped setae 50.0 μ (34.0-58.0) long on segment 8 anterior to vulva, surrounded by 2-4 pairs of short bristle-shaped setae 5.8 μ (2.3-6.9) long. About 1000 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous toward meson; 60.0

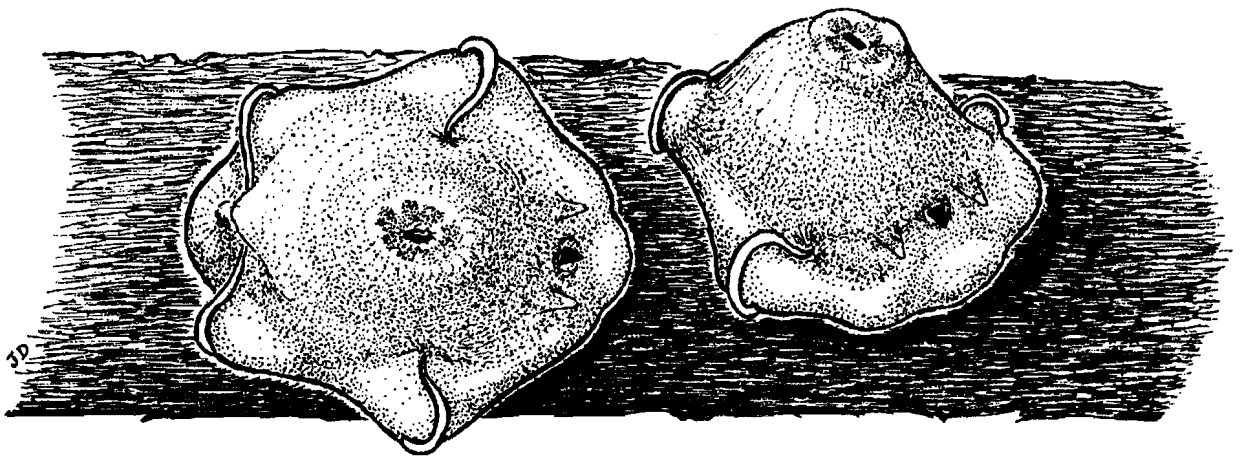


Figure 28. *Ceroplastes rubens.* Wax test adult female. Hawaii, Hawaii, Kona (XII-15-1971, *Persea americana).*

(41.0-108.0) stigmatic pores in irregular band in each stigmatic furrow, extending from spiracular atrium to stigmatic setae, most furrows with predominantly quinquelocular pores, nearly always with several pores with more than 5 loculi; about 200 multilocular pores surround vulva, rarely present on other abdominal segments, absent on thoracic segments. Tubular ducts absent. Legs poorly developed 116.0 μ (101.0-128.0) long; tibia without basal setae, tibia fused with tarsus; tarsal digitules 23.3 μ (20.8-24.3) long; with unequal claw digitules 17.4 μ (15.0-18.5) long; claws without denticles; length of leg segments as follows: coxa 26.1 μ (23.3-32.0), trochanter plus femur 37.8 μ (34.9-58.2), tibia plus tarsus 46.5 μ (43.6-52.4), claw 6.9 μ (5.8-11.6). Antennae 6-segmented, occasionally 5-segmented, 174.2μ (162.0-193.4) long.

SPECIMENS EXAMINED. – **Florida:** Alachua Co., Gainesville (VII-21-1971, host unknown, G. W. Dekle), 14 slides, 15 specimens (WG); Dade Co., Miami (XII-5-1955, *Dizygotheca elegantissima,* L. J. Daigle), 10 slides, 27 specimens (FSCA), location unknown (XII-5-1955, *Philodendron gigantium*, L. J. Daigle), 1 slide, 2 specimens (FSCA); Orange Co., Orlando (X-17-1955, *Aglaonema pictum* 'Tricolor', A. C. Crews), 1 slide, 5 specimens (FSCA), (V-15-1970, *Viburnum* sp., collector unknown), 3 slides, 3 specimens (FSCA); Palm Beach Co., Boynton Beach (V-6-1970, *Aglaonema pictum* 'Tricolor', R. A. Long), 2 slides, 2 specimens (FSCA).

Hawaii: Hawaii, Hilo (V-26-1956, *Alyxia olivaeformis*, E. H. Davidson), 1 slide, 1 specimen (USNM), (VIII-11-1958, *Alyxia olivaeformis*, H. Nakao), 1 slide, 1 specimen (USNM), (V-20-1959, *Alyxia olivaeformis*, S. M. Paaluhi, Jr.), 1 slide, 1 specimen (USNM), (V-6-1965, *Alyxia olivaeformis*, B. Hu), 1 slide, 1 specimen (USNM), (XI-19-1965, *Anthurium* sp., B. Hu), 1 slide, 1 specimen (USNM), (XI-28-1965, *Anthurium andraeanum*, B. Hu), 1 slide, 1 specimen (USNM), (III-19-1966, *Ilex cornuta*, B. Hu), 1 slide, 1 specimen (USNM), (V-10-1966, *Alyxia olivaeformis*, B. Hu), 1 slide, 3 specimens (USNM); Maui, Kanaio (IV-30-1945, *Metrosideros* sp., E. C. Zimmerman), 1 slide, 1 specimen (USNM); Molokai, location unknown (V-30-1943, host unknown, N. L. H. Krauss), 1 slide, 1 specimen (USNM); Oahu, Honolulu (VII-12-1907, *Calocarpum* sp., J. Kotinsky), 2 slides, 2 specimens (USNM), (III-4-1955, *Anthurium* sp., L. J. Aoki), 1 slide, 4 specimens (USNM), (VI-17-1955, *Anthurium* sp., L. J. Aoki), 1 slide, 4 specimens (USNM), (IV-16-1956, *Anthurium* sp., L. J. Aoki), 1 slide, 1 specimen (USNM), (VIII-10-1958, *Barringtonia ragemosa*, K. L. Maehler), 1 slide, 4 specimens (USNM), (III-16-1961, *Anthurium* sp., S. M. Paaluhi, Jr.), 1 slide, 1 specimen (USNM), location unknown (1904, "Mountain apple", F. W. Terry), 2 slides, 5 specimens (USNM), (IX-5-1915, *Pellaea* sp., A. Busck), 1 slide, 3 specimens (USNM), (III-22-1947, *Mangifera* sp., O. G. Stout, 1 slide, 5 specimens (USNM), (IX-5-1952, *Anthurium* sp., E. H. Davidson), 1 slide, 1 specimen (USNM), (IV-7-1955, *Anthurium*

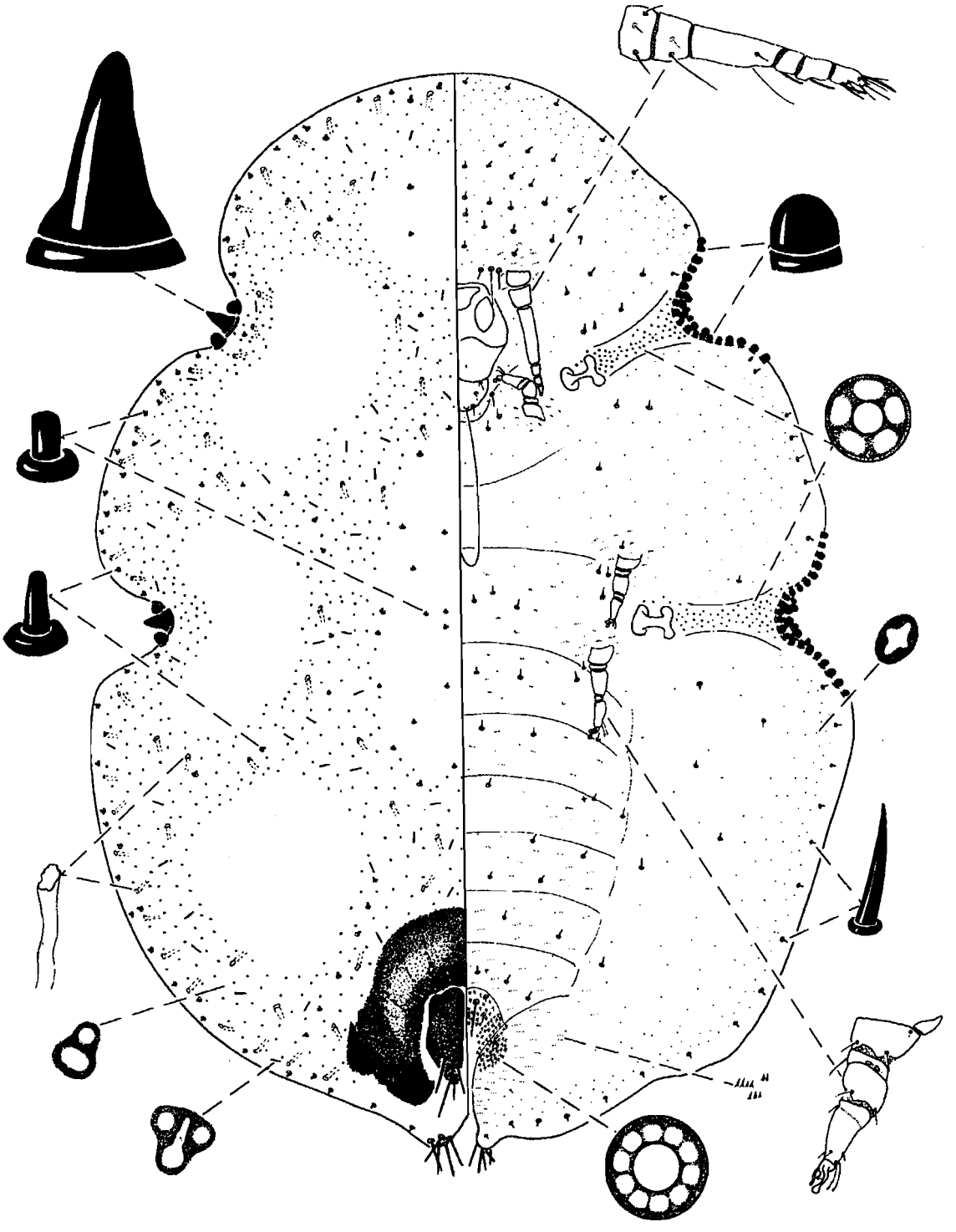


Figure 29. *Ceroplastes rubens.* Slide mounted adult female. Florida, Alachua Co., Gainesville (host unknown, VII-21-1971).

sp., L. J. Aoki), 1 slide, 1 specimen (USNM), (XII-29-1955, *Alpinia "purpurata"*, W. C. Wakefield), 1 slide, 1 specimen (USNM), (VI-9-1958, *Mangifera indica*, R. Y. Miyabara), 1 slide, 1 specimen (USNM), (VII-24-1958, *Anthurium* sp., E. B. Lee), 1 slide, 4 specimens (USNM), (VIII-22-1958, *Anthurium* sp., G. K. Sadoyama), 1 slide, 1 specimen (USNM), (IX-11-1958, *Anthurium* sp., L. Chilson), 1 slide, 1 specimen (USNM); island unknown, Kona (I-26-1961, *Cibotium* sp., S. M. Paaluhi, Jr.), 1 slide, 2 specimen (USNM), Puna (VIII-4-1965, *Alyxia olivaeformis*, B. Hu and Matayoshi, at Hilo), 1 slide, 2 specimens (USNM), (VIII-11-1965, *Alyxia olivaeformis*, B. Hu, at Hilo), 1 slide, 1 specimen (USNM), location unknown (VIII-3-1950, *Gardenia* sp., Friedman, at San Francisco), 1 slide, 1 specimen (USNM), (X-1-1952, *Anthurium* sp., E. B. Fryer), 1 slide, 1 specimen (USNM), (XII-13-1954, *Asplenium* sp., E. H. Davidson), 1 slide, 2 specimens (USNM), (IV-2-1955, *Anthurium* sp., L. J. Aoki), 1 slide, 4 specimens (USNM), (IV-25-1955, *Metrosideros collina*, E. H. Davidson), 1 slide, 2 specimens (USNM), (VI-24-1955, *Alyxia olivaeformis*, E. H. Davidson), 1 slide, 2 specimens (USNM), (X-6-1955, *Alyxia olivaeformis*, E. H. Davidson), 1 slide, 2 specimens (USNM), (II-20-1956, *Alyxia olivaeformis*, E. H. Davidson and K. Sekomoto), 1 slide, 2 specimens (USNM), (IV-4-1958, *Alyxia olivaeformis*, L. M. Chilson), 1 slide, 1 specimen (USNM), (VI-9-1958, *Alyxia olivaeformis*, H. Nakao), 1 slide, 4 specimens (USNM), (VIII-10-1958, *"Molineria recurrata"*, K. L. Maehler), 1 slide, 5 specimens (USNM), (V-5-1965, *Alyxia olivaeformis* B. Hu and G. Fukumura), 1 slide, 3 specimens (USNM), (XI-6-1965, *Gardenia jasminoides*, Parker), 1 slide, 1 specimen (USNM), (V-14-1966, *Eucalyptus* sp., D. Jirard), 1 slide, 1 specimen (USNM).

FOREIGN SPECIMENS EXAMINED – Australia: Queensland, Brisbane (VI-11-1911, *Mangifera* sp., G. Compere), 1 slide, 6 specimens (USNM), (VI-9-1931, *Loranthus "alyxifolius"*, C. T. White), 1 slide, 2 specimens (USNM), (date unknown, host unknown, G. Compere), 1 slide, 1 specimen (USNM), Thursday Island (date unknown, *Eucalyptus* sp., G. Compere), 1 slide, 2 specimens (USNM), location unknown (date unknown, *Mangifera* sp., G. Compere), 1 slide, 3 specimens (USNM), (date unknown, host unknown, G. F. Hill), 1 slide, 2 specimens (USNM); state unknown, location unknown (V-26-1952, *Gardenia* sp., I. Stone, at Hawaii), 1 slide, 3 specimens (USNM), (IV-2-1953, *Gardenia* sp., H. A. Messersmith, at Hawaii), 1 slide, 5 specimens (USNM), (V-23-1958, *Gardenia* sp., R. Greenfield, at Hawaii), 1 slide, 1 specimen (USNM), (XI-26-1969, *Gardenia* sp., W. C. Elliott, at Hawaii), 2 slides, 2 specimens (USNM), (date unknown, host unknown, collector unknown), 8 slides, 8 specimens (USNM).

China: Fukien Province, Haiteng (II-1923, *Rhizophora* sp., S. F. Light), 1 slide, 2 specimens (USNM), location unknown (III-1928, host unknown, C. R. Kellogg), 1 slide, 3 specimens (USNM); Kiangsu Provice, Nanking (VI-2-1925, *Citrus* sp., P. H. Porter), 1 slide, 1 specimen (USNM); Kwangtung Province, Hokshan (I-29-1918, *Rhodomyrtus tomentosa*, C. W. Howard), 1 slide, 1 specimen (USNM); Shantung Province, Shangho (III-2-1900, *Celtis* sp., collector unknown), 1 slide, 2 specimens (USNM); province unknown, Curgo (I-20-1941, *Litchi* sp., collector unknown), 1 slide, 1 specimen (USNM), White Cloud (III-26-1918, *Cudrania javanesis*, C. W. Howard), 1 slide, 1 specimen (USNM).

Fiji Islands: Viti Levu, Suva (VI-29-1932, host unknown E. C. Zimmerman), 1 slide, 1 specimen (USNM), island unknown, location unknown (1906, host unknown, F. Muir), 2 slides, 3 specimens (USNM).

Guam: Mount Santa Rosa (V-16-1945, host unknown, G. E. Bohart and J. L. Gressitt), 1 slide, 1 specimen (USNM), Umatac (II-4-1948, *Ficus* sp., K. L. Maehler), 1 slide, 3 specimens (USNM), location unknown (I-10-1938, *Mangifera* sp., R. G. Oakley), 1 slide, 3 specimens (USNM), (VI-9-1939, *Helianthus* sp., R. G. Oakley), 1 slide, 3 specimens (USNM), (V-9-1945, host unknown, G. E. Bohart and J. L. Gressitt), 1 slide, 1 specimen (USNM), (IV-29-1946, *Cycas* sp., H. L. Krauss), 1 slide, 1 specimen (USNM), (IV-27-1949, "fern", J. Fine, at Hawaii), 1 slide, 1 specimen (USNM), (III-8-1950, *Grammatophyllum* sp., J. Fine and L. B. Loring), 1 slide, 1 specimen (USNM), (IX-19-1953, *Calophyllum* sp., O. N. Liming), 1 slide, 5 specimens (USNM).

Hong Kong: (IV-1-1958, *Rhodomyrtus tomentosa*, N. L. H. Krauss), 1 slide, 1 specimen (USNM), (IV-19-1958, *Rhodomyrtus tomentosa*, N. L. H. Krauss), 1 slide, 1 specimen (USNM), (date unknown, *Pinus* sp., G. Compere), 1 slide, 1 specimen (USNM).

India: Godarari, Kakinada (date unknown, *Cycas* sp., collector unknown), 2 slides, 2 specimens (USNM); district unknown, location unknown (VI-7-1921, host unknown, M. Kisliuk, at Philadelphia), 1 slide, 1 specimen (USNM), (XI-9-1936, host unknown S. S. Sheffield, at Mobile), 1 slide, 2 specimens (USNM).

Japan: Honshu, Kyoto (III-22-1930, *Diospyros kaki*, W. T. Owray) 1 slide, 1 specimen (USNM), Yokohama (XII-28-1917 *Citrus* sp., S. Takahashi), 1 slide, 3 specimens (USNM); island unknown, Yamamota (III-26-1929, *Camellia japonica*, W. B. Wood and W. T. Owray, at Washington, D. C.), 1 slide, 1 specimen (USNM); location unknown (V-19-1916, *Camellia* sp., G. Compere, at San Francisco), 1 slide, 2 specimens (USNM), (VII-2-1921, *Citrus* sp., W. B. Wood, at Washington, D. C.), 1 slide, 1 specimen (USNM), (I-10-1927, host unknown, E. I. Smith, at Seattle), 2 slides, 4 specimens (USNM), (XI-5-1927, host unknown, E. I. Smith, at Seattle), 1 slide, 3 specimens (USNM), (I-14-1928, *Ilex* sp., W. B. Wood, at Washington, D. C.), 1 slide, 3 specimens (USNM), (XI-11-1928, Marantaccae, E. I. Smith, at Seattle), 1 slide, 3 specimens (USNM), (II-20-1931, *Euonymus* sp., W. H. Wheeler, at Seattle), 1 slide, 2 specimens (USNM), (XII-26-1931, host unknown, J. H. Moreland, at New Orleans), 1 slide, 3 specimens (USNM), (X-7-1932, host unknown, W. A. Ranck, at Baltimore), 1 slide, 1 specimen (USNM), (XI-25-1932, *Fatsia japonica*, Baskin and J. C. Pritchett, at New Orleans), 1 slide, 3 specimens (USNM), (XII-21-1932, *Fatsia japonica*, J. C. Pritchett, at New Orleans), 1 slide, 3 specimens (USNM), (III-24-1933, *Citrus* sp., collector unknown, at Bellingham), 1 slide, 1 specimen (USNM), (V-23-1933, *Fatsia japonica*, J. C. Pritchett, at New Orleans), 1 slide, 1 specimen (USNM), (X-22-1933, *Fatsia japonica*, W. H. Wheeler), 1 slide, 2 specimens (USNM), (XI-8-1933, *Fatsia japonica*, M. J. Kerr, at New Orleans), 1 slide, 2 specimens (USNM), (XI-17-1933, *Fatsia japonica*. J. A. Ramos, at Philadelphia), 1 slide, 1 specimen (USNM), (I-24-1934, *Fatsia japonica*, W. H. Wheeler, at Seattle), 1 slide, 1 specimen (USNM), (II-21-1934, *Camellia* sp., J. T. Beauchamp, at Boston), 1 slide, 3 specimens (USNM), (II-23-1934, *Buxus* sp., W. J. Ehinger, at

Philadelphia), 1 slide, 1 specimen (USNM), (III-14-1934, *Fatsia japonica*, J. H. Moreland, at New Orleans), 1 slide, 1 specimen (USNM), (X-30-1934, *Fatsia* sp., C. V. Scott, at Seattle), 1 slide, 2 specimens (USNM), (XI-7-1934, *Fatsia japonica*, R. W. Nicaise, at New Orleans), 1 slide, 3 specimens (USNM), (XI-7-1934, "japonica leaf", U. G. Haddon, at New Orleans), 1 slide, 4 specimens (USNM), (XI-25-1934, *Fatsia japonica*, W. H. Wheeler, at Seattle), 1 slide, 1 specimen (USNM), (XII-12-1934, *Fatsia* sp., C. V. Scott, at Seattle), 1 slide, 1 specimen (USNM), (I-4-1935, host unknown, J. G. Lewis, at New York), 1 slide, 1 specimen (USNM), (II-8-1935, *Fatsia japonica*, J. C. Pritchett, at New Orleans), 1 slide, 2 specimens (USNM), (III-8-1935, *Fatsia japonica*, M. S. Mirimanian, at New Orleans), 1 slide, 1 specimen (USNM), (IV-18-1935, "japonica leaf", V. G. Haddon, at New Orleans), 1 slide, 1 specimen (USNM), (X-13-35, *Fatsia japonica*, J. H. Moreland, at New Orleans), 1 slide, 1 specimen (USNM), (XI-22-1935, *Fatsia japonica*, W. J. Ehinger, at Philadelphia), 1 slide, 1 specimen (USNM), (XI-30-1935, *Citrus deliciosa*, C. V. Scott, at Seattle), 1 slide, 1 specimen (USNM), (XII-2-1935, *Camellia japonica*, Wood and Limber, at Washington, D. C.), 1 slide, 1 specimen (USNM), (XII-13-1935, "japonica leaves", M. S. Mirimanian, at New Orleans), 1 slide, 1 specimen (USNM), (XII-16-1935, *Citrus* sp., M. J. Forsell, at Seattle), 1 slide, 2 specimens (USNM), (XII-23-1935, *Citrus reticulata*, C. G. Latham, at Baltimore), 2 slides, 2 specimens (USNM), (I-6-1936, *Citrus* sp., M. J. Forsell, at Seattle), 1 slide, 3 specimens (USNM), (II-2-1936, *Citrus* sp., J. W. Stanton, at Bellingham), 1 slide, 1 specimen (USNM), (XII-17-1936, *Citrus reticulata*, M. G. Vinzant, at Baltimore), 1 slide, 2 specimens (USNM), (I-12-1937, *Pittosporum* sp., C. V. Scott, at Seattle), 1 slide, 2 specimens (USNM), (XII-15-1937, *Citrus reticulata*, W. W. Chapman, at Philadelphia), 1 slide, 1 specimen (USNM), (XII-12-1938, *Citrus reticulata*, C. V. Scott, at Seattle), 1 slide, 4 specimens (USNM), (IV-13-1939, *Fatsia japonica*, J. P. Young, at Seattle), 1 slide, 1 specimen (USNM), (XII-20-1939, *Camellia* sp., C. V. Scott, at Seattle), 1 slide, 2 specimens (USNM), (XII-21-1939, *Camellia japonica*, J. P. Young, at Seattle), 1 slide, 1 specimen (USNM), (XII-1939, *Citrus* sp., J. McDunnough, at Vancouver, B. C.), 1 slide, 3 specimens (USNM), (II-17-1940, *Camellia sasanqua* 'Hirgo', C. V. Scott, at Seattle), 1 slide, 2 specimens (USNM), (XI-30-1940, *Camellia* sp., E. I. Smith, at Seattle), 1 slide, 2 specimens (USNM), (XII-30-1940, *Magnolia salicifolia*, J. C. Pritchett, at Seattle), 1 slide, 1 specimen (USNM), (I-17-1941, *Camellia* sp., E. I. Smith, at Seattle), 2 slides, 2 specimens (USNM), (II-14-1946, *Malus* sp., Barber, at San Francisco), 1 slide, 1 specimen (USNM), (X-13-1947, host unknown, R. P. Owen, at Seattle), 1 slide, 1 specimen (USNM), (XII-2-1947, *Pittosporum* sp., C. V. Scott, at Seattle), 2 slides, 2 specimens (USNM), (III-14-1948, *Chaenomeles* sp., R. P. Owen, at Seattle), 1 slide, 1 specimen (USNM), (XI-8-1948, *Camellia* sp., H. C. Nelson, at Seattle), 1 slide, 1 specimen (USNM), (VIII-21-1951, *Pinus parviflora*, F. L. Blanc, at San Diego), 1 slide, 1 specimen (USNM), (IX-6-1952, host unknown, R. B. Harding, at Hawaii), 1 slide, 2 specimens (USNM), (XII-31-1952, *Kadsura japonica*, R. Kennelty), 1 slide, 6 specimens (USNM), (I-19-1954, *Citrus* sp., J. Freedland, at Philadelphia), 1 slide, 1 specimen (USNM), (IX-16-1955, *Camellia rusticans*, W. B. Wood, at Maryland), 2 slides, 4 specimens (USNM), (X-12-1955), *Hedera helix*, W. C. Wakefield, at Hawaii), 1 slide, 2 specimens (USNM), (X-12-1955, *Gardenia* sp., W. C. Wakefield, at Hawaii), 1 slide, 1 specimen (USNM), (II-1-1956, *Camellia rusticans*, F. P. Hubert and W. B. Wood, at Washington, D. C.), 1 slide, 1 specimen (USNM), (VII-13-1965, *Gardenia* sp., J. F. Byrnes), 1 slide, 3 specimens (USNM), (X-7-1969, *Burya japonica*, A. Paterson, at Portland), 1 slide, 1 specimen (USNM).

Java: Buitenzorg (VII-21-1926, *Mangifera* sp., H. Y. Gouldman), 1 slide, 1 specimen (USNM), location unknown (VIII-26-1930, *Mangifera* sp., W. I. Whiton, at Washington, D. C.), 2 slides, 3 specimens (USNM), (W. B. Wood, at Washington, D. C.), 2 slides, 4 specimens (USNM).

Malaysia: Kuala Lumpur (IX-1929, *Citrus* sp., C. P. Clausen), 1 slide, 2 specimens (USNM).

Philippines: Luzon, Manila (III-13-1909, *Psidium guajava*, C. S. Banks), 1 slide, 1 specimen (USNM), (III-28-1911, "Palm", collector unknown), 1 slide, 3 specimens (USNM), (III-23-1925, *Mangifera* sp., M. de G. Rodriques), 1 slide, 2 specimens (USNM); Mindanao Island, Zamboanga (VIII-13-1962, *Mangifera indica*, R. C. Reyes), 1 slide, 5 specimens (USNM); Negros, Victorias (XII-21-1929, *Mangifera* sp., W. D. Pierce), 1 slide, 2 specimens (USNM); location unknown (1934, *Aglaonema* sp., collector unknown, at New Orleans), 1 slide, 1 specimen (USNM).

Rota: Son Son (VI-28-1946, *Cycas* sp., R. G. Oakley) 1 slide, 1 specimen (USNM).

Samoa: Tutuila (VIII-18-1940, host unknown, Swezey), 2 slides, 3 specimens (USNM), (V-7-1941, host unknown, H. L. Krauss), 2 slides, 4 specimens (USNM).

Saipan: Magicienne Bay (II-25-1949, *Barringtonia* sp., K. L. Maehler, at Hawaii), 1 slide, 1 specimen (USNM). Tanapag Harbor (VI-2-1946, host unknown, Townes), 1 slide, 1 specimen (USNM), U. S. C. C. Farm (VI-17-1946, *Mangifera* sp., R. G. Oakley), 1 slide, 1 specimen (USNM).

Tahiti: location unknown (XII-25-1960, *Polypodium* sp., S. Toba, at Hawaii), 1 slide, 1 specimen (USNM), (I-30-1972, *Acacia* sp., J. R. Davidson), 1 slide, 1 specimen (USNM).

Taiwan: Kagi (XII-25-1927, *Mangifera* sp., R. Tokahashi), 1 slide, 2 specimens (USNM), location unknown (VIII-22-1956, *Camellia* sp., J. A. Lindsay, at San Pedro), 1 slide, 4 specimens (USNM), (XII-19-1970, *Cephalotaxus* sp., J. Mabry), 1 slide, 1 specimen (USNM).

HOSTS AND DISTRIBUTION – Based on our records, *rubens* was first established in the continental U. S. in Florida in 1955. Although it has been eradicated (Dekle 1963), small infestations have been discovered and destroyed since that time. We are not sure of the area of natural occurrence of *rubens*, but Craw (1896) indicated that it was native to India. This species is known from India, Australia, China, Japan, Hawaii, and other Pacific islands.

The host list is diverse with citrus, avocado, palm, and gardenia as preferred hosts.

ECONOMIC IMPORTANCE – *C. rubens* is a major pest of citrus (Ebeling 1959) in Australia, Hawaii, and Japan. It also attacks mango, tea, palm, and gardenia, as well as several non-agricultural hosts. Although *rubens*

has been intercepted on plant materials at many quarantine stations in the U. S., to the best of our knowledge, it has only become established in Florida. These population have been eradicated (Dekle 1963), as discovered. New introductions are a constant threat to Florida and other southern states and therefore economic entomologists, citrus growers, and nurserymen should be on the lookout for this species.

BIOLOGY – Only biological characteristics of apparent taxonomic importance are given here. Specimens of *rubens* are found on the stems, branches, and leaves of its host. Once the crawler has settled, the remaining instars stay in the same spot. Individual wax tests normally remain distinct even in heavy infestations. Males have been reported in Japan by Kuwana (1923).

DISCUSSION – *C. rubens* is the only known species of *Ceroplastes* that occurs in the U. S. that possesses reduced and distorted legs. This character at once separates it from all other U. S. species.

Ceroplastes sinensis Del Guercio
Suggested Common Name: Chinese Wax Scale
Figure 5(5), 7(4), 30, 31, 32

Ceroplastes sinensis Del Guercio, 1900, p. 232.

TYPE DATA – The type locality is Liguria, Italy, and the type host is *Citrus* sp. We have seen 6 topotype specimens. These specimens are mounted on 2 slides labeled with the following information: "*Ceroplastes sinensis* del Guer on *Erica arborea* near Sestri Levante in Ligurien, Italien March 21, 1913. O. Jaap, coll. Jaap Coll. No. 168 Bur. Ent. purchase 1930"; and "*Ceroplates sinensis* del Guer. On *Schinus molle* L. Italy: Bordighali in Ligurien Otto Jaap Coll. Feb. 3, 1913 Jaap Coll. No. 144 Bur. Ent. Purchase 1930." Although we have not seen type material of this species, it is well known and there is little question as to its identity.

FIELD CHARACTERS – The following description is based on fresh material.

Test: wet wax rectangular in young females rectangular in old specimens in dorsal view, hemispherical in lateral view, without horn, white in young females reddish brown in old material, marginal flange small or absent on young specimens not hiding lateral filaments, flange large on old females, normally partially hiding lateral filaments, divided into 1 dorsal and 6 lateral plates on young females, plates normally absent on old specimens, young specimens with nuclei, old specimens with dorsal nucleus only. Dry wax with filaments as follows: cephalic filament trifurcate, with rounded apices; anterolateral, mediolateral, and posterolateral filaments simple; caudal filaments weakly bifurcate; dorsal dry wax of first and second instars forming central cap, surrounded by small dorsomedial nucleus; dorsal dry wax not tilted. Stigmatic wax bands present near both pairs of spiracles, anterior bands directed dorsally, filamentous wax confined to stigmatic areas. Length 4.0 mm (2.0-7.0), width 3.5 mm (2.0-6.0), height 3.0 mm (1.5-5.0).

Body: elliptical, reddish brown; anal process short.

SLIDE MOUNTED CHARACTERS – Adult female elliptical, length 2.8 mm (1.4-4.6), width 2.2 mm (0.9-4.0).

Dorsum: membranous in young adult females, slightly sclerotized in older adult females; with 1 cephalic, 1 mediodorsal, and 6 lateral clear areas devoid of pores and setae except cephalic area with 1 or 2 cylindrical setae; dorsal setae variable (fig. 7(4)), about 120 cylindrical and conical setae normally with pointed or rounded apices, 5.3 μ (4.4-11.6) long. Dorsal pores distributed as follows: about 150 bilocular pores concentrated on submargin; about 690 oval trilocular pores evenly distributed, 225 triangular trilocular pores evenly distributed; about 16.0 quadrilocular pores mainly located in mesal area; about 5 quinquelocular pores mainly located anterior to anal process. Tubular ducts absent. Anal plates each with 2 ventral and 4 dorsal setae.

Margin: marginal bristle-shaped setae 21.3 μ (13.2-26.5) long, placed as follows: 6.0 (5.0-7.0) between eye tubercles, 2.0 (1.0-3.0) between each eye tubercle and each anterior stigmatic furrow, 3.0 (2.0-4.0) between each anterior and posterior stigmatic furrow, 9.0 (8.0-10.0) between each posterior stigmatic furrow and anal cleft, last 3 or 4 thicker, longer, 34.0 μ (17.4-46.0), in cluster on anal lobes, stigmatic setae hemispherical, bullet-shaped, or lanceolate, larger setae sometimes bent (fig. 5(5)), length 1.0 to 2.0 times

greater than width at base, 34.0 (18.0-43.0) laterad of each stigmatic furrow in 3 or 4 irregular rows, length from 4.4 - 26.0 μ long. Filamentous ducts in 1 row along ventral submargin between marginal bristle-shaped setae and cruciform pores, with dermal orifice predominantly monolocular, occasionally bilocular. Eye tubercles slightly protruding.

Venter: membranous; bristle-shaped setae placed as follows: 42.0 (35.0-49.0) on each submargin, 9.5 μ (6.9-14.6) long, 2.0 (1.0-3.0) associated with each coxa, 4.0 (2.0-5.0) in cephalic region, 4.0 (1.0-6.0) on each abdominal and thoracic segment; interantennal space with 1 pair of lateral bristle-shaped setae 9.2 μ (6.5-11.6) long, 1 pair of mesal bristle-shaped setae 48.0 μ (24.0-54.5) long; 1 pair of mesal bristle-shaped setae 53.8 μ (24.0-75.8) long on segment 8 anterior of vulva, surrounded by 2 - 4 pairs of short bristle-shaped setae, 9.5 μ (6.9-11.3) long. About 70 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous toward meson; 52.0 (42.0-85.0) stigmatic pores in irregular band in each stigmatic furrow, extending from spiracular atrium to stigmatic setae, most furrows predominantly with quinquelocular pores, nearly always with several pores with more than 5 loculi, specimens from California with about equal numbers of quinquelocular pores and pores with more than 5 loculi; about 150 multilocular pores surround vulva, 70.0 (64.0-87.0) on seventh and sixth abdominal segments, normally absent on remaining abdominal and thoracic segments. Tubular ducts with slightly asymmetrical cups, each duct with inner filament nearly as long and much narrower than basal part of duct, arranged in 2 clusters as follows: 18.0 (10.0-24.0) in cephalic region; 20.0 (18.0-43.0) in region of vulva. Legs 430.4 μ (387.2-555.0) long; tibia normally with basal setae, tibia less than 2 times length of tarsus, with tibiotarsal scleroses; tarsal digitules 49.0 μ (43.5-60.1) long; with equal claw digitules 30.7 μ (27.8-38.0) long; claws with very small denticles; apparently absent on California specimens; length of leg segments as follows: coxa 77.2 μ (70.0-87.0), trochanter plus femur 158.0 μ (142.5-190.0), tibia 102.7 μ (87.0-120.0), tarsus 72.8 μ (67.5-81.0), claw 20.9 μ (20.2-26.8) long. Antennae 7-segmented, 259.0 μ (223.0-284.0) long.

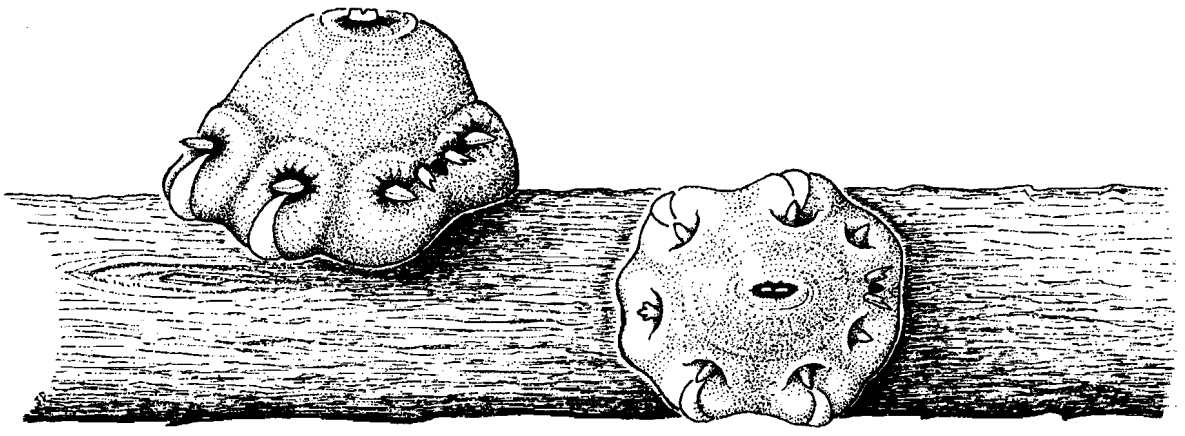


Figure 30. *Ceroplastes sinensis.* Wax test young adult female. Maryland, Prince Georges Co., College Park, University greenhouse (VI-5-1972, *Ilex crenata* 'Microphylla').

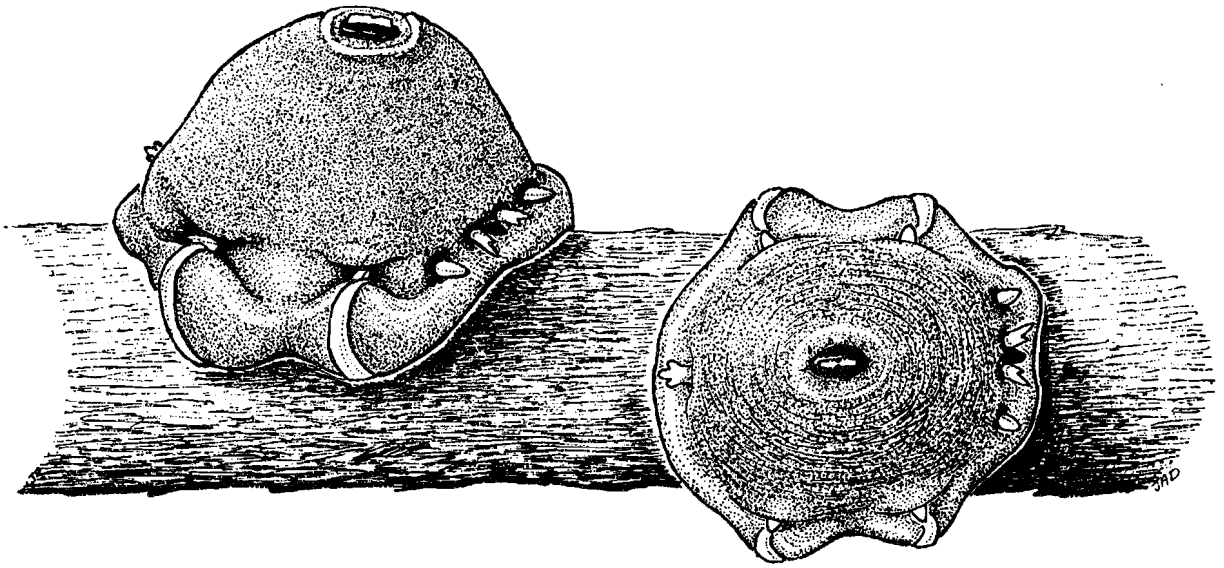


Figure 31. *Ceroplastes sinensis.* Wax test old adult female. Maryland, Prince Georges Co., College Park, University greenhouse (VI-20-1972, *Ilex crenata* 'Microphylla').

SPECIMENS EXAMINED – California: Alameda Co., Fremont (III-16-1972, *Schinus molle,* Henning) 5 slides, 5 specimens (CDA), (IV-6-1972, *Baccharis* sp., Henning), 1 slide, 2 specimens (CDA); San Mateo Co., San Carlos (IX-12-1971, *Escallonia rubra,* H. Struffeneller), 1 slide, 1 specimen (CDA), Palo Alto (VII-22-1966, *Montanus* sp., C. M. Sill), 1 slide, 1 specimen (CDA), East Palo Alto (VI-10-1971, *Cotoneaster dammeri,* H. Struffeneller), 2 slides, 2 specimens (CDA); Santa Clara Co., San Jose (VI-2-1969, *Ilex aquifolium,* J. Castro, A. Gilbert), 2 slides, 6 specimens (CDA, USNM), Mountainview (X-30-1970, *Citrus* sp., D. Schamberger), 4 slides, 4 specimens (CDA).

North Carolina: Carteret Co., Beaufort (VIII-23-1920, *Ilex vomitoria,* R. L. Barney), 1 slide, 1 specimen (USNM).

Virginia: Independent city: Franklin (I-27-1969, *Ilex crenata* 'Microphylla', J. Pierce), 8 slides, 15 specimens (WG), (IX-12-1969, *Ilex crenata* 'Microphylla', D. K. Pollet), 3 slides, 3 specimens (WG), (X-27-1969, *Ilex crenata* 'Microphylla', J. Pierce), 27 slides, 31 specimens (WG), (XI-5-1970, *Ilex crenata* 'Microphylla', J. Whitehead), 10 slides, 10 specimens (WG).

FOREIGN SPECIMENS EXAMINED – Australia: New South Wales, Sydney (X-19-1970, *Syzygium* sp., D. P. Sands), 8 slides, 8 specimens (MW).

France: location unknown (I-17-1935, *Citrus* sp., Latham, Fyke, Petsch, at New York), 1 slide, 4 specimens (USNM).

Italy: Ligurien (II-3-1913, *Schinus molle,* O. Jaap), 1 slide, 4 specimens (USNM), (III-21-1913, *Erica arborea,* O. Jaap), 1 slide, 1 specimen (USNM); location unknown (III-24-1917), host unknown, F. Silvestri), 1 slide, 2 specimens (USNM), (XII-10-1926, host unknown, F. Silvestri), 1 slide, 2 specimens (USNM), (V-31-1933, Lauraceae, W. J. Ehinger, at Philadelphia), 1 slide, 1 specimen (USNM), (XI-14-1935, *Citrus* sp., Sartor, at New York), 1 slide, 1 specimen (USNM), (III-20-1955, *Citrus* sp., Maloney, Tuthill, at New York), 1 slide, 3 specimens (USNM).

Madeira Islands: Madeira, Funchal (I-1921, *Streptosolen jamesoni,* T. D. A. Cockerell), 1 slide, 2 specimens (USNM), S. Rogue (1923, *Pyrus communis* 'Sativa', A. Noronha), 1 slide, 2 specimens (USNM), location unknown (I-1921, *Streptosolen* sp., T. D. A. Cockerell), 1 slide, 1 specimen (USNM).

Mexico: Vera Cruz, Totalco (II-29-1972, Leguminosae shrub, D. R. Miller and F. D. Parker), 6 slides, 12 specimens (USNM).

Morocco: Rabat (X-27-1953, *Citrus* sp., W. B. Wood), 1 slide, 1 specimen (USNM).

New Zealand: location unknown (V-25-1951, *Feijoa* sp., L. B. Loring, at Honolulu), 1 slide, 2 specimens (USNM).

Spain: location unknown (VI-5-1928, host unknown, A. Boera), 26 slides, 26 specimens (USNM).

HOSTS AND DISTRIBUTION – *C. sinensis* was first reported in the U. S. by Williams and Kosztarab (1972). It was collected as early as 1920 in North Carolina but prior to 1972 was misidentified as *cirripediformis.* Because *sinensis* has been introduced into many areas of the world, it is difficult to infer its native area of origin. Morphologically it is relatively similar to *cirripediformis,* which is a New World species, but the presence of

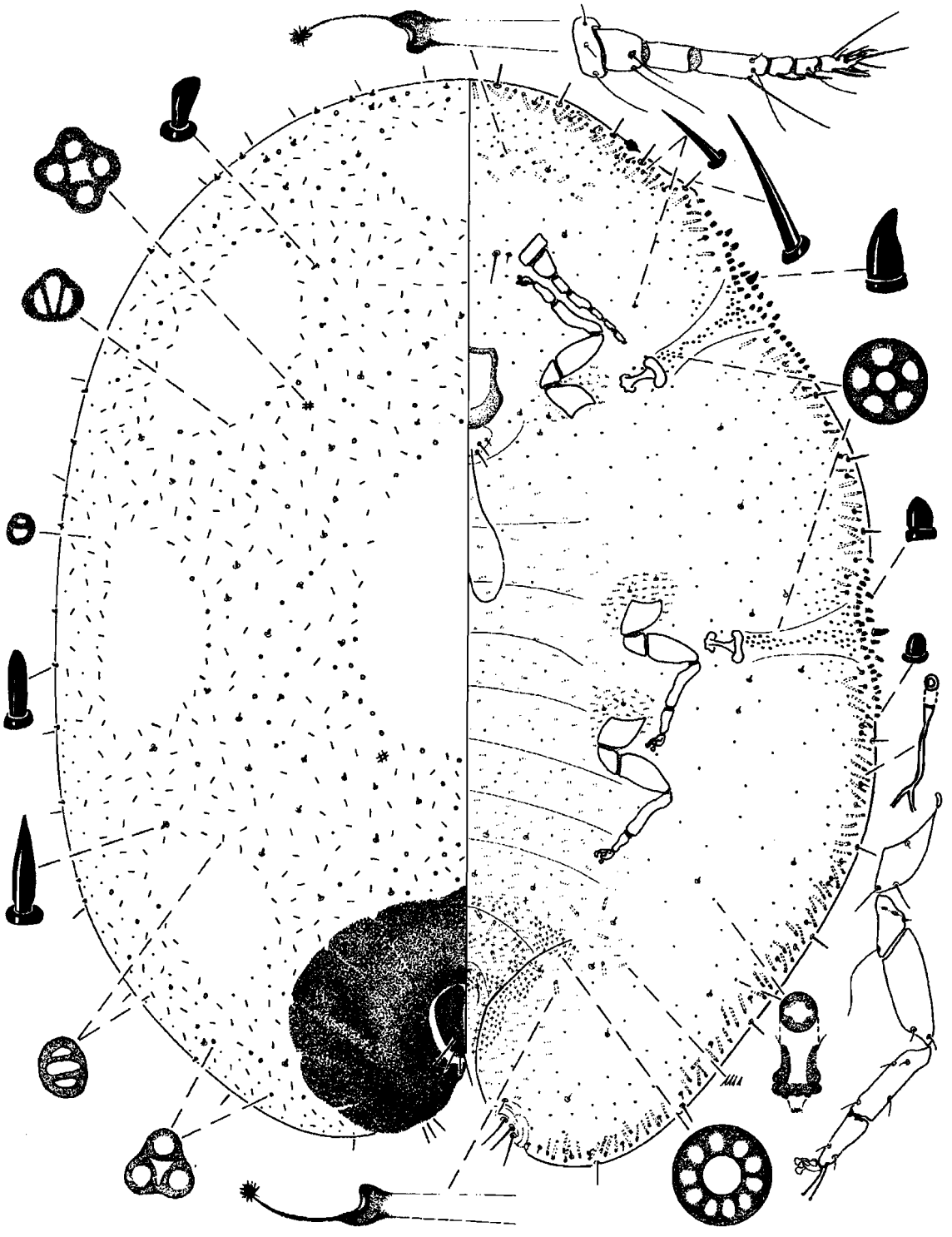


Figure 32. *Ceroplastes sinensis.* Slide mounted adult female. California, Santa Clara Co., Mountain View (X-30-1970, *Citrus* sp.).

filamentous ducts suggests affinity with *ceriferus* of the Old World. Del Guercio (1900) suggested that it was native to China, whereas Balachowsky (1933) believed that it was native to South America or Africa. Because of the similarities between *sinensis* and *mexicanus (= cirripediformis)*, Cockerell (1901) alluded that *sinensis* might be native to Mexico. This species is commonly encountered in the Mediterranean area, but is also widely distributed in many other parts of the world. The infestations in the U. S. are apparently derived from past introductions.

The host list of this species in other parts of the world is extensive; in Australia, Snowball (1970) reports it from 59 species of host plants; in Russia, Borchsenius (1957) records it on 12 host families. Preferred hosts in the U. S. are *Citrus* and *Ilex*.

ECONOMIC IMPORTANCE – *C. sinensis* is a pest of *Citrus* and many ornamental trees and shrubs outside of the U. S. In the U. S. its hosts and distribution are limited, but because it is a pest in other parts of the world and because it has been recorded from *Citrus* in California, economic entomologists should be cognizant of its potential as a pest species.

BIOLOGY – Only biological characteristics of apparent taxonomic importance are given here; a more detailed biological treatment will be presented in a future paper. *C. sinensis* crawlers normally settle on the upper leaf surface along the major veins. Third instars usually migrate from the leaves to the stems soon after molting. Individual wax tests remain distinct even in dense populations. Although we have not found males in the U. S. Snowball (1970) reported finding males comprising 2.5% of the population in Australia.

DISCUSSION – In the U. S. there are 2 populations of *sinensis*, 1 located in California south of San Francisco Bay, the other in southeastern Virginia. The material from Virginia appears to be most typical of *sinensis* and has a very small, but distinct claw denticle, hemispherical stigmatic setae, stigmatic pores in the stigmatic furrow predominantly quinquelocular, multilocular pores predominantly with 10 loculi, and filamentous ducts that appear to have a monolocular orifice. In contrast, the California specimens lack the claw denticle, have stigmatic setae with more pointed apices, stigmatic pores in the stigmatic furrow about 1/2 quinquelocular and 1/2 with more than 5 loculi, multilocular pores predominantly with 12-14 loculi, and the filamentous ducts appear to have a bilocular orifice. Although these 2 populations are distinct in the U. S., material from other areas of the world share characters in common with both the California and the Virginia specimens. Some material otherwise typical of *sinensis* has either stigmatic setae with pointed apices, or stigmatic furrows with many stigmatic pores with more than 5 loculi, or multilocular pores predominantly with 12-14 loculi. Although no typical *sinensis* material has been found which lacks a claw denticle, we don't presently consider this character by itself to be of enough significance to separate the California population as a different species. Furthermore, many important characters are shared by the 2 U. S. populations; some of these are the presence of the filamentous ducts, the presence of setae on the proximal end of the tibiae, placement of the stigmatic setae, and restriction of the multiloculars to the posterior abdominal segments. Based on the above information, we presently believe that both U. S. populations belong to *sinensis*.

C. sinensis is characterized as follows: dorsal setae predominantly with pointed apices and with 1 margin slightly expanded; with 2 ventral setae on each anal plate; with about 34 stigmatic setae laterad of each stigmatic furrow, these setae are hemispherical, bullet-shaped, or lanceolate with rounded to pointed apices; with a ventral submarginal band of filamentous ducts; multilocular pores present on abdominal segments 6 - 8, rarely present on segment 5; legs with tibiotarsal scleroses, equal claw digitules, occasionally with a very small claw denticle; antennae normally 7-segmented.

Of the foreign species examined, *purpureus* Hempel most nearly resembles *sinensis*. *C. purpureus* differs as follows: with 1 ventral seta on each anal plate; with from 17 - 25 stigmatic setae laterad of each stigmatic furrow; with the large seta in the outer row hemispherical or bullet-shaped with rounded or truncate apices; absence of a ventral submarginal band of filamentous ducts; multilocular pores present on all abdominal segments; legs without tibiotarsal scleroses; antennae normally 6-segmented. Whereas, *sinensis* possesses: 2 ventral setae on each anal plate; from 18 - 43 stigmatic setae laterad of each stigmatic furrow; with the large seta in the outer row either bullet-shaped with rounded or pointed apices or lanceolate with the apical third bent; with a ventral submarginal band of filamentous ducts; multilocular pores absent on abdominal segments 2 and 3; legs with tibiotarsal scleroses; antennae normally 7-segmented. Another species, *albolineatus*, also resembles *sinensis* in possessing filamentous ducts. But, because only a single very poor specimen of authentic *albolineatus* has been available for this study, it is difficult to draw definitive conclusions

about its relationship to other species of *Ceroplastes*. However, it has been possible to distinguish *albolineatus* and *sinensis*. *C. albolineatus* possesses: dorsal setae which are predominantly cylindrical with obliquely truncate apices; what appears to be a dorsal and a ventral submarginal row of filamentous ducts. Whereas, *sinensis* possesses: dorsal setae which are cylindrical and predominantly have 1 margin slightly expanded, with pointed apices; only a ventral submarginal row of filamentous ducts.

In the U. S., *sinensis* most nearly resembles *brachyurus* and *cirripediformis*. For a comparison of differences between *sinensis* and these species see the discussion sections of *brachyurus* and *cirripediformis*.

Ceroplastes utilis Cockerell
Suggested Common Name: Candle Wax Scale
Figure 5(6), 7(5), 33

Ceroplastes utilis Cockerell; Riley and Howard, 1892, p. 139 [Nomen nudum].
Ceroplastes utilis Cockerell, 1893b, p. 83.
Ceroplastes dozieri Cockerell and Bueker, 1930, p. 7. [New synonymy].

TYPE DATA – The type locality is the Island of Grand Turk. The type host is "a tree or bush not identified, with brownish grey bark, and small entire or slightly crenate leaves with oblique bases." Cockerell did not designate a holotype specimen in his original description of this species. We here designate as lectotype (1 adult female on 1 slide) a syntype mounted from dry material used by Cockerell in the description of this species. The label reads, "Lectotype *Ceroplastes utilis* Ckll. West Indies Island of Grand Turk 1892 Dr. Strachan coll. mounted Ex dry mat. VI 1971 DET. W. F. GIMPEL". Also we designate the specimens marked "TYPE" (4 adult females on 2 slides, 2 per slide) from Cockerell's original type series as paralectotypes. The labels on slide 1 contain the following information: left label, "*Ceroplastes utilis* Ckll. Type West Indies Dr. Strachan ex Ckll. Coll." Right label, "Paralectotype #1 DET. W. F. GIMPEL." The labels on slide no. 2 contain the following information: left label, "*Ceroplastes utilis* Ckll. Type W. I. Dr. Stachau [sic]." right label, "Paralectotype #2 DET. W. F. GIMPEL". Unmounted dry paralectotypes are in a box labeled, "*Ceroplastes utilis* Ckll. TYPE Ckll. Coll. W. E. (Dr. Strachan)." A note inside the box reads "*Ceroplastes utilis* Ckll. TYPE. See orig. description." The lectotype and paralectotypes are deposited in the USNM.

We have examined topotypic specimens of *dozieri* collected by H. L. Dozier and consider it to be a junior synonym of *utilis*.

FIELD CHARACTERS – The following description is based on dry material.

Test: oval in dorsal view, hemispherical laterally, without horn, translucent green or yellow in young females, slate gray in old specimens, without marginal flange, plates, and nuclei. Dry wax filaments not seen; dorsal dry wax of first and second instars forming central cap, not surrounded by nucleus. Stigmatic wax bands present near both pairs of spiracles, anterior bands directed dorsally, filamentous wax confined to stigmatic areas. Length 4.0 mm (2.0-6.0), width 3.5 mm (1.8-5.7), height 2.0 mm (1.2-4.1).

Body: elliptical, reddish brown, anal process short.

SLIDE MOUNTED CHARACTERS – Adult female oval anteriorly, bluntly rounded to truncate posteriorly, length 3.6 mm (1.8-5.7), width 3.0 mm (1.0-4.6).

Dorsum: membranous in young adult females, slightly sclerotized in older adult females; with 1 cephalic, 1 mediodorsal, and 6 lateral clear areas devoid of pores and setae except cephalic area with 4 cylindrical setae; dorsal setae variable (fig. 7(5)), about 200 cylindrical or conical setae with bluntly rounded, pointed, or obliquely truncate apices 8.7 μ (4.4-10.4) long. Dorsal pores distributed as follows: about 200 bilocular pores concentrated near submargin; irregular oval trilocular pores variable 900 (400-1350), evenly distributed, about 200 triangular trilocular pores evenly distributed; about 12 quadrilocular pores mainly located in mesal area; quinquelocular pores absent. Tubular ducts absent. Anal plates each with 1 ventral and 4 dorsal setae.

Margin: marginal bristle-shaped setae 23.3 μ (19.6-26.2) long, (ventral submarginal setae are often as long as the marginal setae, therefore, they may be confused with one another, see page 13 for further discussion) placed as follows: 6.0 (4.0-7.0) between eye tubercles, 2.0 (1.0-3.0) between each eye tubercle and each anterior stigmatic furrow, 2.0 (1.0-4.0) between each anterior and posterior stigmatic furrow, 9.0 (8.0-10.0) between each posterior stigmatic furrow and anal cleft, last 3 longer, 48.5 μ (35.0-60.0), in cluster on

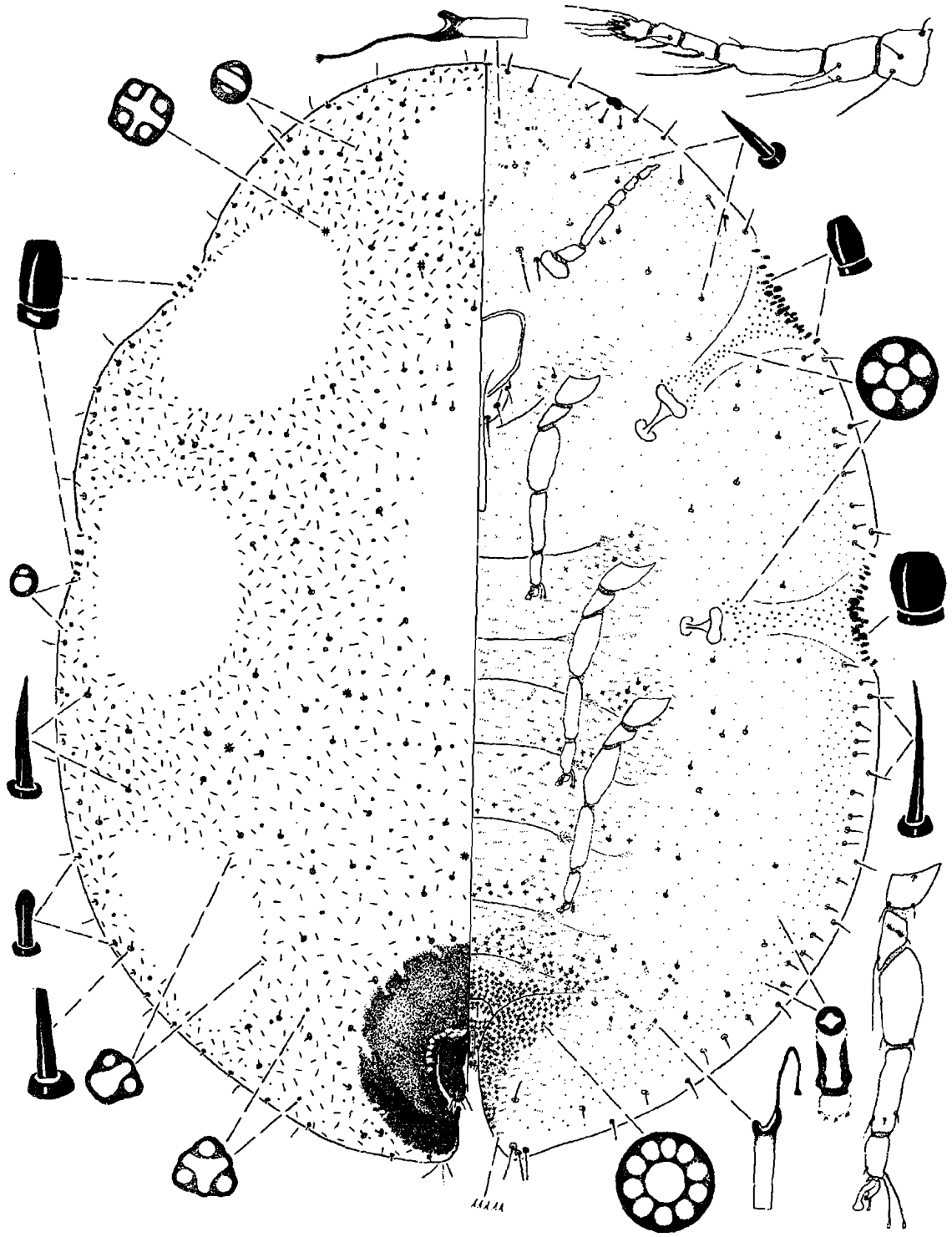


Figure 33. *Ceroplastes utilis.* Slide mounted adult female. West Indies, Grand Turk (1892, host unknown).

anal lobes; stigmatic setae cylindrical, with bluntly rounded to truncate apices (fig. 5(6)), length 1.0 - 2.0 times greater than width at base, 25.0 (18.0-32.0) laterad of each stigmatic furrow in 2 to 4 irregular rows, length from 8.7 - 15.0 long. Filamentous ducts absent. Eye tubercles slightly protruding.

Venter: membranous; bristle-shaped setae of 2 sizes, those on the submargin 17.4 μ (12.9-24.0) long, placed as follows: 4.0 (3.0-9.0) between eye tubercles, 5.0 (3.0-6.0) between each eye tubercle and each anterior stigmatic furrow, 8.0 (5.0-10.0) between each anterior and posterior stigmatic furrow, 20.0 (18.0-23.0) between each posterior stigmatic furrow and anal cleft; shorter bristle-shaped setae 8.7 μ (6.1-15.2) long, placed as follows: 3.0 (2.0-4.0) associated with each coxa, 8.0 (6.0-12.0) in cephalic region, 6.0 (4.0-12.0) on each abdominal and thoracic segment; interantennal space with 1 pair of lateral bristle-shaped setae 15.0 μ (11.1-29.1) long, 1 pair of mesal bristle-shaped setae 60.1 μ (31.2-79.0) long; 1 pair of mesal bristle-shaped setae 53.3 μ (43.0-65.7) long on segment 8 anterior of vulva, surrounded by 3 pairs of short bristle-shaped setae 13.1 μ (8.7-17.5) long. About 1500 cruciform pores, concentrated on submargin, scattered on remainder of venter, becoming less numerous towards meson; 70.0 (64.0-150.0) stigmatic pores in irregular band in each stigmatic furrow, extending from spiracular atrium to stigmatic setae, most furrows with pores having form 5 - 10 loculi, pores near spriacular setae predominantly with more than 5 loculi; about 450 multilocular pores surround vulva, 150.0 (127.0-163.0) on seventh abdominal segment, 50.0 (43.0-56.0) on sixth abdominal segment, 18.0 (10.0-24.0) on each preceding abdominal segment, 4.0 (0.0-6.0) near base of meso- and metacoxae, absent from prothorax. Tubular ducts with slightly asymmetrical cups, each duct with inner filament nearly as long and much narrower than basal part of duct, arranged in 2 clusters as follows: 14.0 (12.0-17.0) in cephalic region; 36.0 (32.0-51.0) in region of vulva. Legs 251.4 μ (229.1-294.0) long; tibia without basal setae, prothoracic tibiae about 2 times length of prothoracic tarsi, meso- and metathoracic tibiae occasionally less than 2 times length of meso- and metathoracic tarsi, without tibiotarsal scleroses; tarsal digitules 33.0 μ (28.4-37.5) long; with unequal claw digitules 24.5 μ (15.2-26.2) long; claws with small denticles; length of leg segments as follows: coxa 39.1 μ (32.7-52.4), trochanter plus femur 107.3 μ (87.0-120.0), tibia 68.3 μ (60.0-82.6), tarsus 35.9 μ (30.5-43.6), claw 16.4 μ (13.2-19.7) long. Antennae 6-segmented, 242.0 μ (218.0-272.3) long.

SPECIMENS EXAMINED – Florida: Monroe Co., Pine Key (XII-4-1970, *Eugenia* sp., S. Nakahara), 1 slide, 1 specimen (USNM), Key West (XII-4-1970, *Avicennia marina*, S. Nakahara), 5 slides, 5 specimens (USNM); Co. unknown, Cape Sable, Big Madaline Hammick (II-21-1940, *Crataegus* sp., C. F. Rainwater), 1 slide, 4 specimens (USNM).

FOREIGN SPECIMENS EXAMINED – Haiti: Port-au-Prince (VIII-16-1924, *Catalpa longissima*, G. N. Walcott), 2 slides, 4 specimens (USNM), Puantes (XI-14-1929, *Maytenus "buxifolia"*, H. L. Dozier), 15 slides, 20 specimens (USNM).

West Indies: Grand Turk (1892, host unknown, Strachan), 1 slide, 1 specimen (USNM), location unknown (date unknown, host unknown, Strachan), 2 slides, 4 specimens (USNM).

HOSTS AND DISTRIBUTION – *C. utilis* has not previously been recorded from the U. S. Although it was collected as early as 1940 in Florida, it was identified as *Ceroplastes* sp. This species is probably native to the Caribbean Islands. The current distribution includes the Greater Antilles and southern Florida. In the U. S. it probably does not occur outside of Florida.

Because the host list is varied, it is difficult to indicate a preferred host.

ECONOMIC IMPORTANCE – *C. utilis* is of no apparent economic importance.

BIOLOGY – Only biological characteristics of apparent taxonomic importance are given here. All instars of *utilis* are normally found on the stems and branches of their hosts and do not migrate from 1 area of the host to another. In heavy infestations, individual wax tests tend to fuse together, completely surrounding infested branches. Males have not been recorded for this species.

DISCUSSION – *C. utilis* is characterized as follows: dorsal setae predominatly cylindrical with rounded, pointed, or obliquely truncate apices, with 1 ventral seta on each anal plate; with about 25 stigmatic setae laterad of each stigmatic furrow which are cylindrical with bluntly rounded to truncate apices; without filamentous ducts; ventral submarginal row of bristle-shaped setae nearly as long as marginal setae; legs unusually short, about 251 μ long, without tibiotarsal scleroses, prothoracic tibiae about 2 times length of prothoracic tarsi, with unequal claw digitules, with small claw denticle; antennae 6-segmented.

Of the foreign species examined, *caesalpinia* Reyne according to Reyne (1964) is allied to *utilis*. We do not consider these 2 species closely related. *C. caesalpinia* differs as follows: with about 95 stigmatic setae laterad of each stigmatic furrow which are cylindrical with rounded apices; with equal claw digitules, without claw denticle; antennae 7-segmented. Whereas, *utilis*

possesses: about 25 cylindrical stigmatic setae laterad of each stigmatic furrow which are cylindrical with bluntly rounded or truncate apices; unequal claw digitules, a claw denticle; antennae 6-segmented.

In the U. S., *utilis* most nearly resembles *nakaharai*. For a comparison of differences between *utilis* and *nakaharai* see the discussion section of *nakaharai*.

CEROPLASTES ADULT MALES

Unfortunately, the adult males of only 2 U. S. species are known. Therefore, it seems illogical to present a generalized morphological discussion at this time. However, because the males of these species show relationships to other coccid genera different from those shown by the females, it seems of value to discuss briefly these affinities.

According to Giliomee (1967), based on the adult males of 23 species and 19 genera, the family Coccidae can be divided into 4 "groups" of genera. Unlike the studies of Borchsenius (1957) and Bodenheimer (1953), Giliomee does not regard *Ceroplastes* as constituting a "group" of its own. In fact, he points out that the adult males of *Ceroplastes* are very similar to the males of *Coccus*, genus B near *Pulvinaria*, *Pulvinaria*, and *Parthenolecanium*. *Ceroplastes* can be separeated from these genera in having caudal extension of abdominal segment 7 (ce_7) with fleshy setae (fs), with a conspicuous eversible endophallus (ee), and a differently shaped head.

ABBREVIATIONS FOR MORPHOLOGY OF ADULT MALES

The following should be useful for figures 34 and 35.

a = aedeagus
ab =antennal bristle
an = anus
as = anterior spiracle
b = coxal bristles
br = basal rod
bs = basisternum
bss = bristle-shaped setae
c = cicatrix
ce_7 = caudal extension of abdominal segment 7
ce_8 = caudal extension of abdominal segment 8
cs = capitate setae
d = denticle
de = dorsal eye
dmr = dorsal arm of midcranial ridge
dps = dorsopleural setae
ee = eversible endophallus
epm_3 = metepimeron
f = furca
fs = fleshy setae
gn = genae
gp = glandular pouch
ib = intersegmental bulges
lmr = lateral arms of mid-cranial ridge
lp = lateropleurite
lps = lateral pronotal sclerite
ls = lateral sclerotization
m = medial ridge of basi-$sternum_2$
ma = membranous apex
mc = median crest
me_2 = mesepisternum
me_3 = metepisternum
mp = metasternal plate
mpr = mesopleural ridge
mr = marginal ridge
mtr = metapleural ridge
o = ocellus
os = ocular sclerite
p = pedicel
pc_2 = precoxal ridge of meso-thorax
pn_2 = mesopostnotum
pn_3 = metapostnotum
psn = penial sheath
po = preoral ridge
por = postocular ridge
pr = pronotal ridge
prr = preocular ridge
ps = prescutum
psn = prosternum
psp = posterior spiracle
scm = scutum
sf = scutellar foramen
slm = scutellum
sma = scutal membranous area
sp = simple pore
tb = tegular bulge
td = tarsal digitules
ud = claw digitules
ve = ventral eye
vmr = ventral arm of mid-cranial ridge
vpor = ventral branch of postocular bridge
vps = ventropleural setae

KEY TO SLIDE MOUNTED ADULT MALE *CEROPLASTES* IN THE UNITED STATES

1. With glandular pouch and associated elongate setae; penial sheath apically pointed and membranous; fleshy setae present on basal portion of penial sheath; about 45 setae on scutum . . . . . *cirripediformis* Comstock

   Without glandular pouch and associated setae; penial sheath apically rounded and sclerotized; fleshy setae absent on basal portion of penial sheath; about 23 setae on scutum . . . . . *ceriferus* (Fabricius)

DESCRIPTION OF ADULT MALES

Ceroplastes ceriferus (Fabricius)
Figure 34

SLIDE MOUNTED CHARACTERS. – Adult male mounted, 1.2 - 1.3 mm long and 0.4-0.5 mm wide. The body, particularly the abdomen, is unusually broad for a coccid, but this is likely due to distortion caused by mounting.

Dorsum: with 0 - 5 simple pores (sp) on abdominal segment 1, with 0 - 2 on segment 2. Setae unusually abundant, of 2 types, fleshy setae (fs) most numerous, bristle-shaped setae (bss) uncommon; present on head on median crest (mc), on ocular sclerites (os), and on genae (gn), on thorax on scutum (scm), on scutellum (slm), and on tegular bulge (tb), on abdomen on medial and submedial areas of abdominal segments 2 - 8. Head with median crest with pentagonal reticulation, with posterior apex broadly rounded. Dorsal arm of midcranial ridge (dmr) weakly developed. Ocular sclerite and genae with pentagonal reticulation, with 1 pair of dorsal eyes (de), each about 41 μ in diameter, lateral ocelli (o) about 20 μ in diameter. Postocular ridge (por) well-developed, without ventral branch near ocellus. Interocular ridge absent. Thorax with pronotal ridge (pr) well-developed, interrupted medially, lateral pronotal sclerite (lps) small and lightly sclerotized. Post-tergites apparently absent. Prescutum (ps) with irregular reticulation and with the median part more heavily sclerotized posteriorly. Mesoprephragma deeply emarginate. Scutum with membranous area (sma) trapezoidal (note distorted shape on main illustration; see enlargement for normal shape), with unusually large number of setae (about 45); anterolateral portion of scutum with irregular or pentagonal reticulation. Scutellum tube-like, with relatively large scutellar foramen (sf). Mesopostnotum (pn_2) weakly sclerotized sometimes with reticulation. Metapostnotum (pn_3) apparently absent. Abdomen with tergites poorly developed or absent on abdominal segments 1 - 5, well-developed on segments 6 - 8, becoming more heavily sclerotized posteriorly.

Margin: with dorsopleural setae (dps) present from mesothora to abdominal segment 7, predominantly of the fleshy type, but with 1 or 2 short bristle-shaped setae on each posterior abdominal segment; ventropleural setae (vps) present on abdominal segments 3 or 4 - 7, predominantly of fleshy type, bristle-shaped setae normally present on posterior abdominal segments. Marginal region of abdominal segment 7 with a pair of conspicuous caudal extensions (ce_7) which are sclerotized ventrally and laterally, each extension with about 23 setae. Abdominal segment 8 with a small pair of sclerotized caudal extensions (ce_8) each bearing 5 or 6 short bristle-shaped setae and a small, weakly sclerotized cicatrix (c), about 9μ in diameter. Glandular pouch absent, without associated pores or setae.

Genitalia: penial sheath (pns) 235 - 260μ long; ratio of width of sheath at level of base of aedeagus (a): total sheath length 1: 5.4 - 1: 6.4; ratio of length of sheath: length of body 1: 4.9 - 1: 5.2. Apex of sheath broadly rounded, with sclerotized apex. Penial sheath with about 6 fleshy setae along each margin in addition to small number of short bristle-shaped setae scattered over remainder of sheath, setae absent near base of sheath. Lateral sclerotization (ls) joined anterior to anus (an). Length of basal rod (br) noticeably longer than length of aedeagus. Eversible endophallus (ee) evident.

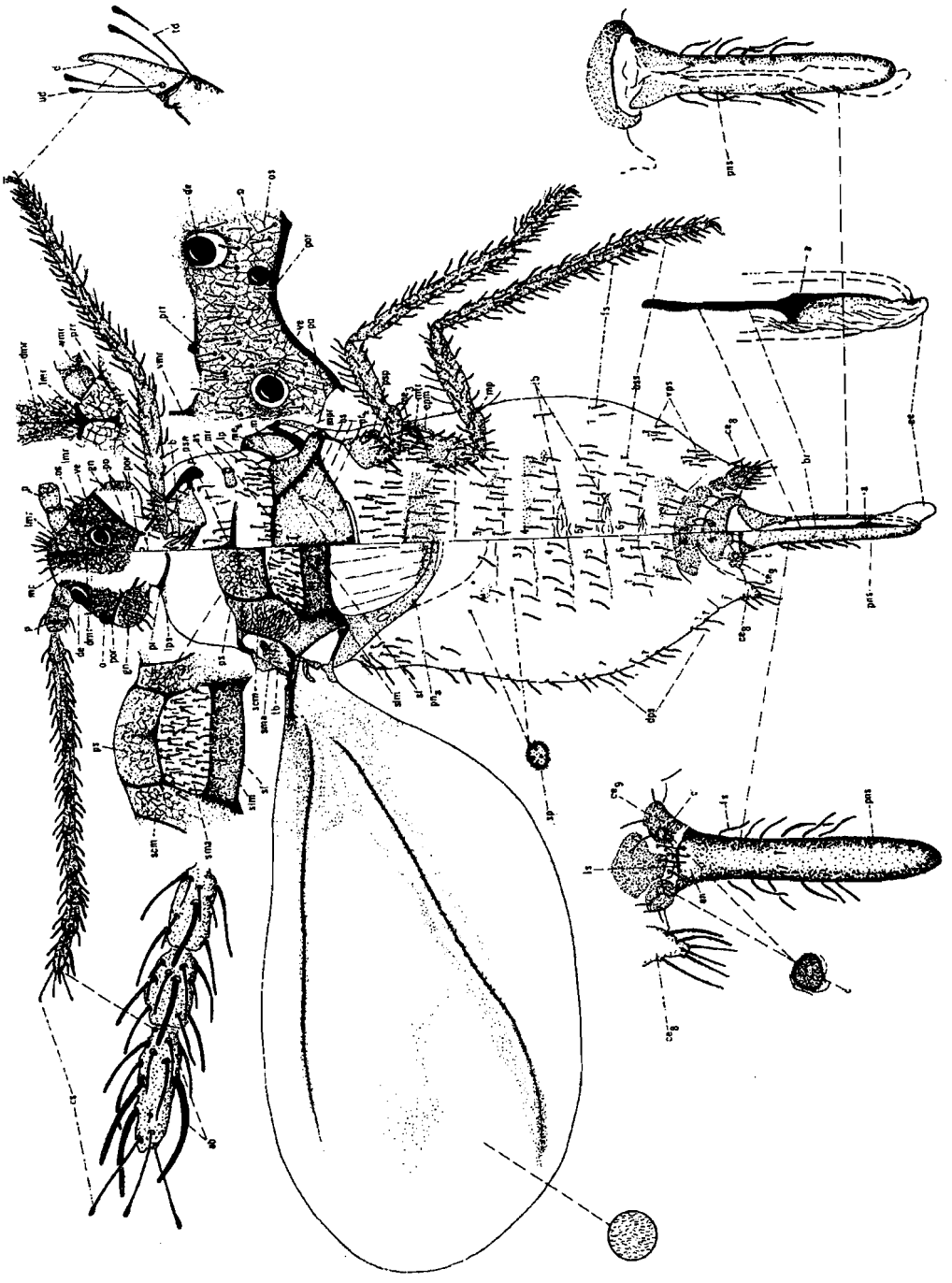


Figure 34. *Ceroplastes ceriferus.* Slide mounted adult male. Maryland, Prince Georges Co., College Park, University greenhouse (III-13-1972, *Ilex cornuta* 'Burfordii').

Venter: with body setae unusually abundant, primarily of fleshy type, but with a few bristle-shaped setae; present on head on ocular sclerite, on genae, and near midcranial ridge, on thorax near anterior coxae, near prosternum (psn), posterior of anterior spiracle (as), anterior of mesosternum, on mesosternum, medially between each pair of meso- and metathoracic legs, and posterior to hind pair of spiracles (psp), on abdomen on medial and submedial areas of segments 2 - 7. Head with ventral arm of midcranial ridge (vmr) attached to ocular sclerite, lateral arms of ridge (lmr) well-developed. Area surrounding midcranial ridge posterior to lateral arm with pentagonal reticulation, but without sclerotization. Preocular ridge (prr) not attached to midcranial ridge. With 1 pair of ventral eyes (ve) about 38μ in diameter. Postocular and preoral (po) ridges well-developed. Cranial apophysis bifurcate, extending forward to level of posterior margin of ventral eyes. Thorax with prosternum with well-developed transverse ridge, medial ridge weakly developed, triangular sclerite nearly absent. Mesopleural ridge (mpr) well-developed, not interrupted above coxal articulation. Mesepisternum (me_2) not reticulated. Lateropleurite (lp) bounded by thin portion of marginal ridge (mr). Basisternum (bs) of mesothorax with conspicuous median (m), marginal, and precoxal (pc_2) ridges. Furca (f) well-developed. Pleural ridge of metathorax (mtr) short; small precoxal ridge present or absent. Metepisternum (me_3) small, triangular. Metepimeron (epm_3) small. Metasternal plate (mp) nearly rectangular, more heavily sclerotized near anterior margin. Abdomen with sternites present on anterior and posterior segments; sternite on segment 8 nearly contiguous with sclerotization of caudal extension; sclerotization of sternites on abdominal segments 7 and 8 conspicuous. With intersegmental bulges (ib) present between segments 3 and 4, 4 and 5, 5 and 6.

Wings: developed only on mesothorax, hamulohaltera absent. Wings each about 1000μ long, width: length ratio about 1: 1.9. Wings without alar setae.

Appendages: antennae 10-segmented, 557 - 600μ long, ratio of antennal length: total body length 1: 2.1 - 1: 2.6, pedicel (p) faintly reticulated, apical segment with 3 capitate setae (cs), segments 2 - 10 with numerous fleshy setae and 1 or 2 bristle-shaped setae, segments 8 - 10 also with several antennal bristles (ab), segment 1 with bristle-shaped setae only. Legs with fleshy and bristle-shaped setae numerous, tarsal digitules (td) capitate, not reaching tip of claws, claw digitules (ud) also capitate, extending beyond tip of claws; claws normally with small denticle (d). Front legs about 690μ long, coxae with 3 or 4 capitate coxal bristles (b); middle legs about 720μ long; hind legs about 790μ long.

SPECIMENS EXAMINED – **Maryland:** Prince Georges Co., College Park (greenhouse reared) (III-13-1972, *Ilex cornuta* 'Burfordii', W. F. Gimpel) 2 slides, 2 specimens (USNM); (IV-4-1972, *Euonymus japonicus*, W. F. Gimpel) 1 slide, 1 specimen (W. G.) (VII-5-1972, *Ilex cornuta* 'Burfordii', W. F. Gimpel) 1 slide, 1 specimen (USNM).

Virginia: Montgomery Co., Blacksburg (greenhouse reared) (V-10-1972, *Ilex cornuta* 'Burdordii', D. K. Pollet) 11 slides, 11 specimens (VPI) (USNM).

DISCUSSION – The adult male of *ceriferus* is apparently very similar to the adult male of *pseudoceriferus*. Unfortunately, no specimens of the latter have been available for study, but illustrations and descriptions provided by Sankaran (1962) give insight into the general morphology of *pseudoceriferus*. The only difference evident, based on his illustration is the apparent lack of large fleshy setae on the lateral margin of the sheath which are present on *ceriferus*. However, Sankaran does state "stylus (penial sheath) covered with small, pointed setae and long flexible hairs along its sides." This statement implies that the fleshy setae on the margin of the penial sheath may in fact be present on *pseudoceriferus*, but are not illustrated.

In the U. S. only the adult males of *cirripediformis* and *ceriferus* have been collected. *C. cirripediformis* differs as follows: with fleshy setae present on basal portion of penial sheath; penial sheath with apex pointed and membranous; with a glandular pouch and associated elongate setae; with large cicatrix; with about 45 setae on scutum; and with short penial sheath. Whereas, *ceriferus* possesses: no fleshy setae near basal portion of penial sheath; penial sheath with apex rounded and sclerotized; without a glandular pouch and associated setae; with small cicatrix; with about 23 setae on scutum; and with long penial sheath.

Ceroplastes cirripediformis Comstock
Figure 35

SLIDE MOUNTED CHARACTERS – Adult male mounted, 1.2 mm long and 0.4 mm wide. The body is broad.

Dorsum: without simple pores (sp). Setae not as abundant as on *ceriferus*, of 2 types, fleshy setae (fs) most numerous, bristle-shaped setae (bss) uncommon;

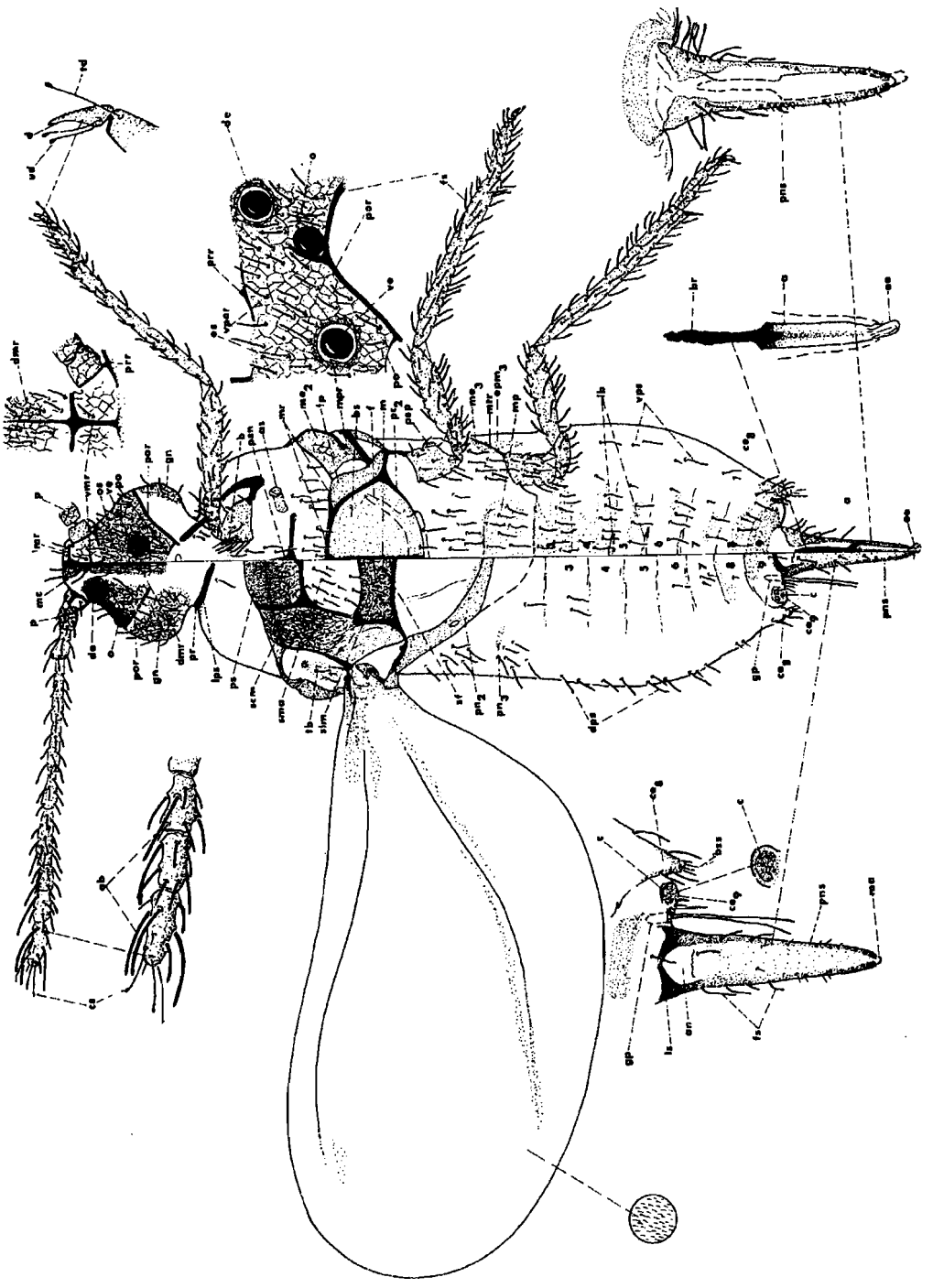


Figure 35. *Ceroplastes cirripediformis.* Slide mounted adult male. Florida, Polk Co., Lakeland (V-25-1972, *Dizygotheca elegantissima*).

present on head on median crest (mc), on ocular sclerites (os), and on genae (gn), on thorax on scutum (scm), on scutellum (slm), and on tegular bulge (tb), on abdomen on medial and submedial areas of abdominal segments 2 - 8. Head with median crest with pentagonal reticulation, with posterior apex truncate. Dorsal arm of midcranial ridge (dmr) weakly developed. Ocular sclerite and genae with pentagonal reticulation, with 1 pair of dorsal eyes (de), each about 32 μ in diameter, lateral ocelli (o) about 23 μ in diameter. Postocular ridge (por) well-developed, interrupted medially, lateral pronotal sclerite (lps) small. Post-tergites apparently absent. Prescutum (ps) with irregular reticulation and with the median part slightly more heavily sclerotized posteriorly. Mesophragma deeply emarginate. Scutum with membranous area (sma) trapezoidal, with small numbers of setae (about 23); anterolateral portion of scutum with irregular reticulation. Scutellum tube like, with small scutellar foramen (sf). Mesopostnotum (pn_2) without reticulation. Metapostnotum (pn_3) weakly sclerotized laterally, absent medially. Abdomen with tergites weakly sclerotized, restricted to anterior portions of segments 7 and 8.

Margin: with dorsopleural setae (dps) present from mesothorax to abdominal segment 7, predominantly of fleshy type, but with few bristle-shaped setae; ventropleural setae (vps) present on abdominal segments 3 - 7, predominantly of fleshy type. Marginal region of abdominal segment 7 with 1 pair of small caudal extensions (ce_7) which are weakly sclerotized, each extension with about 15 setae. Abdominal segment 8 with 1 small pair of sclerotized caudal extensions (ce_8) each bearing about 3 bristle-shaped setae, and 1 large sclerotized cicatrix (c) about 29 μ in diameter. Glandular pouch (gp) present, with numerous associated pores and 2 setae each approximately 130 μ long.

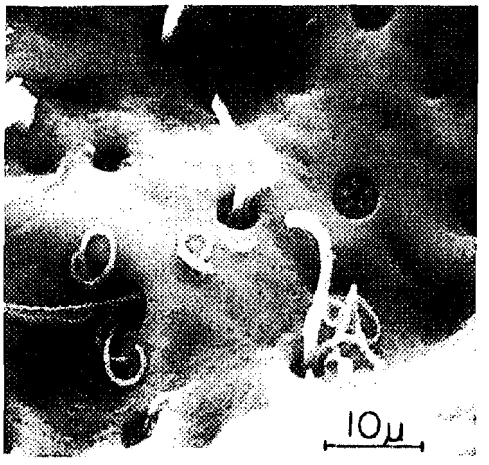
Genitalia: penial sheath (pns) 186 μ long; ratio of width of sheath at level of base of aedeagus (a): total sheath length 1: 4.7; ratio of length of sheath: length of body 1: 6.2. Apex of sheath pointed, with membranous apex (ma). Penial sheath with about 11 fleshy setae present near base and along each margin, with short bristle-shaped setae scattered over remainder of sheath. Lateral sclerotization (ls) joined anterior of anus (an). Length of basal rod (br) shorter or equal to length of aedeagus. Eversible endophallus (ee) evident.

Venter: with body setae in relatively normal numbers, primarily of fleshy type, but with few bristle-shaped setae; present on head on ocular sclerite, on genae, and near midcranial ridge, on thorax near prosternum (psn), posterior of anterior spiracle (as), anterior of mesosternum, on mesosternum, medially between each pair of meso- and metathoracic legs, and posterior to posterior pair of spiracles (psp), on abdomen on medial and submedial areas of segments 2 - 7. Head with ventral arm of midcranial ridge (vmr) attached to ocular sclerite, lateral arms of ridge (lmr) well-developed. Area surrounding midcranial ridge posterior to lateral arm with pentagonal reticulation, but without sclerotization. Preocular ridge (prr) not attached to midcranial ridge. With 1 pair of ventral eyes (ve) about 32 μ in diameter. Postocular and preoral (po) ridges well-developed. Cranial apophysis bifurcate, extending forward to level of middle of ventral eyes. Thorax with prosternum with well-developed transverse ridge, medial ridge and triangular sclerite nearly absent. Mesopleural ridge (mpr) well-developed, not interrupted above coxal articulation. Mesepisternum (me_2) with small amount of pentagonal reticulation. Lateropleurite (1p) partially bounded by marginal ridge (mr). Basisternum (bs) of mesothorax with conspicuous median (m), marginal, and precoxal (pc_2) ridges. Furca (f) well-developed. Metapleural ridge (mtr) short; precoxal ridge apparently absent; metepisternum (me_3) large, triangular; metepimeron (epm_3) small. Metasternal plate (mp) rectangular, more heavily sclerotized along anterior margin. Abdomen with sternites present on abdominal segments 2 - 8 with sternite on segment 8 most well-developed. Small intersegmental bulges (ib) present between segments 3 and 4, 4 and 5, and 5 and 6.

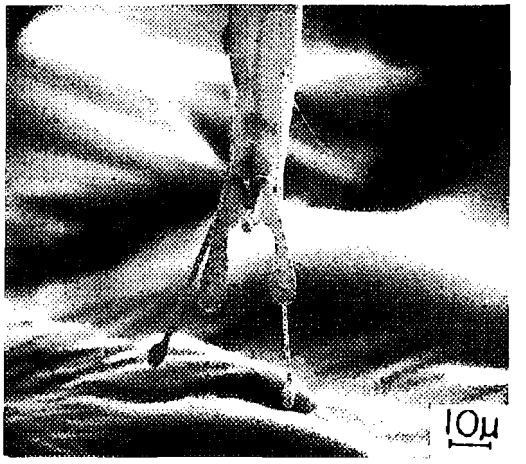
Wings: developed only on mesothorax, hamulohaltera absent. Wings each about 840 μ long, width: length ratio about 1: 2.2. Wings without alar setae.

Appendages: antennae 10-segmented, about 516 μ long, ratio of antennal length: total body length 1: 2.2, pedicel (p) with conspicuous reticulation, apical segment with 3 capitate setae (cs), segments 2 - 10 with numerous fleshy setae and 0 -2 bristle-shaped setae, segments 8 - 10 also with several antennal bristles (ab) segment 1 with bristle-shaped setae only. Legs with fleshy and bristle-shaped setae numerous, tarsal digitules (td) capitate, extending beyond tip of claws only on front legs, claw digitules (ud) also capitate, extending beyond tip of claws; claws with small denticle (d). Front legs about 571 μ long, coxae with 5 or 6 coxal bristles (b) apparently without capitate apices; middle legs about 574 μ long; hind legs about 603 μ long.

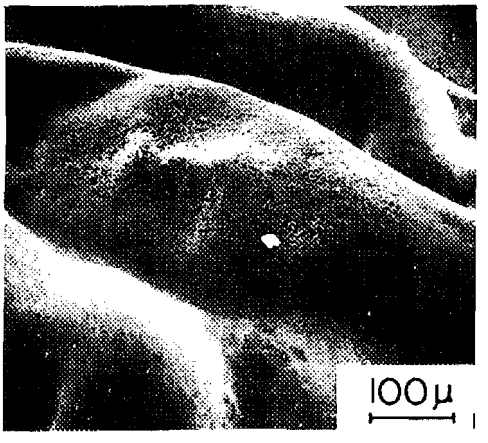
SPECIMENS EXAMINED – Florida: Polk County, Lakeland (VII-22-1972, *Dizygotheca elegantissima* I. W. McLeod) 1 slide, 1 specimen (USNM).



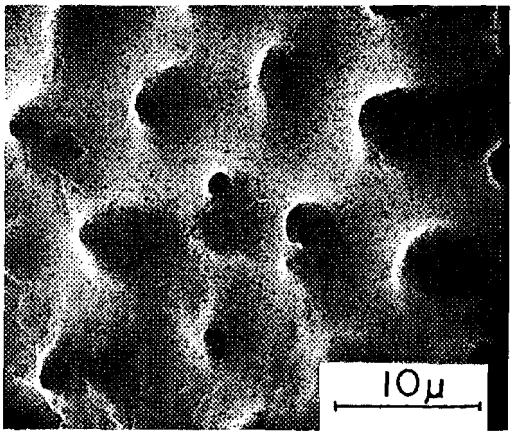
(a)



(b)

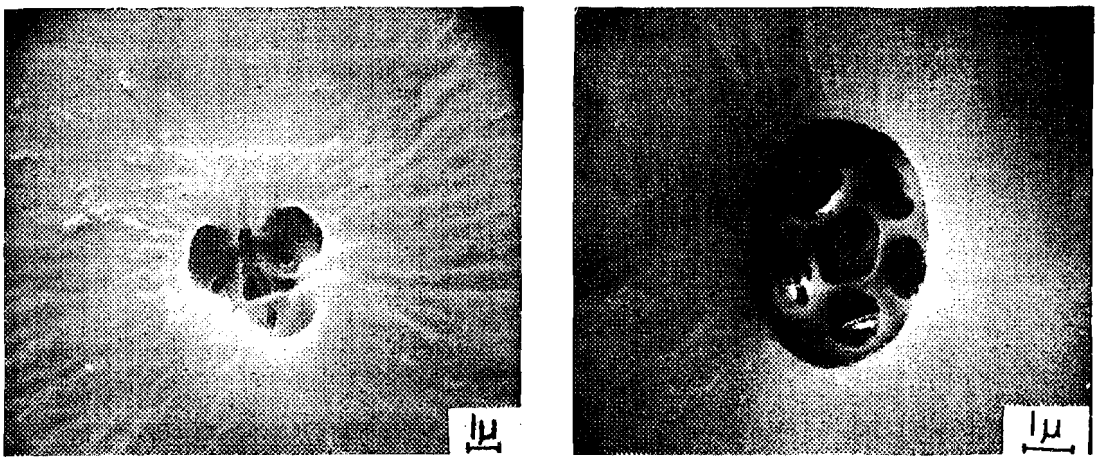


(c)

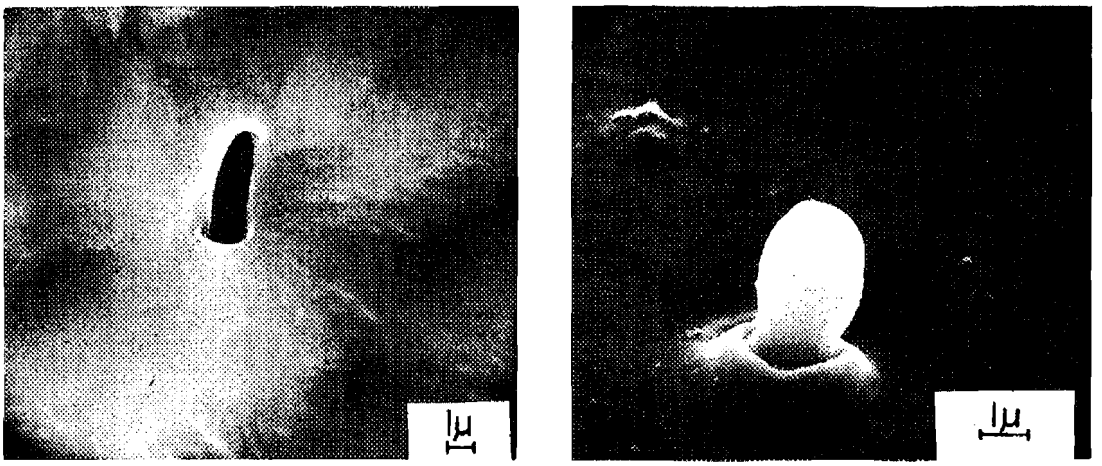


(d)

Plate 1. Scanning electron micrographs
a. stigmatic pores with wax secretion-*nakaharai*,
b. apex of leg showing equal claw digitules-*cirripediformis*,
c. clear area showing primary wax pores-*dugesii*,
d. primary wax pores-*dugesii*.



(a) (b)



(c) (d)

Plate 2. Scanning electron micrographs
a. triangular trilocular pore-*ceriferus*,
b. stigmatic pore-*nakaharai*,
c. orifice ventral tubular duct-*nakaharai*,
d. capitate dorsal seta-*cirripediformis*.

LIST OF *CEROPLASTES* SPECIES BY STATE

This list includes only specimens which we have examined

	brachyurus	ceriferus	cirripediformis	cistudiformis	dugesii	floridensis	irregularis	nakaharai	rubens	sinensis	utilis	Number of species
Alabama	X	X	X									3
Arizona	X		X				X					3
Arkansas		X										1
California			X	X			X			X		4
Florida		X	X		X	X		X	X		X	7
Georgia		X	X			X						3
Hawaii			X						X			2
Idaho							X					1
Illinois		X										1
Louisiana			X			X						2
Maryland		X	X			X						3
Mississippi			X			X						2
Missouri						X						1
Nevada							X					1
New Jersey		X										1
New Mexico						X	X					2
New York		X				X						2
North Carolina		X	X			X				X		4
Ohio			X									1
Pennsylvania			X									1
South Carolina		X	X									2
Texas		X	X			X	X					4
Virginia		X				X				X		3
Washington, D. C.		X	X			X						3

DISCUSSION – Since this description is based on only 1 specimen, it is entirely possible that minor changes will be needed when more material is available. The question has been raised as to how we can be certain that this actually is a male of *cirripediformis* and not some other soft scale. It should be pointed out that the male was taken from under a test similar in structure to a 2nd instar female test, but more elongate. Ten pupae or prepupae were also found. In addition the male has features which are diagnostic of *Ceroplastes.*

Of the adult males of *Ceroplastes* which have been described in detail, *berliniae* Hall most closely resembles *cirripediformis. C. berliniae* differs as follows: without dorsal arm of midcranial ridge; with a dorsal as well as ventral branch of postocular ridge; post-tergites large and conspicuous; with pentagonal reticulation of prescutum and scutum; without coxal bristles on front coxae; penial sheath long, about 402 μ long; ratio of penial sheath length: body, length about 1: 3.8; and without fleshy setae on penial sheath. Whereas, *cirripediformis* possesses: a conspicuous dorsal arm of midcranial ridge; only a ventral branch of postocular ridge; post-tergites which are apparently absent; irregular reticulation on prescutum and scutum; coxal bristles on front coxae; short penial sheath, about 186 μ long; ratio of penial sheath length: body length about 1: 6.2; and numerous fleshy setae on penial sheath.

In the U. S. the only other male known is that of *ceriferus*. For a comparison of *cirripediformis* and *ceriferus* see discussion of *ceriferus*.

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HOST INDEX

This index includes only records which we have confirmed. It does not include hosts reported in the literature which we could not substanitate.

Cycas sp.
rubens
Cydonia sp.
floridensis
Diospyros kaki
cirripediformis
floridensis
rubens
Diospyros silvestris
dugesii
Diospyros sp.
cirripediformis
dugesii
Dizygotheca elegantissima
cirripediformis
rubens
Dodonaea viscosa
cirripediformis
Duranta repens
cirripediformis
Ehretia anacua
cirripediformis
Erica arborea
sinensis
Eriobotrya japonica
floridensis
Escallonia rubra
sinensis
Eucalyptus sp.
rubens
Eugenia sp.
floridensis
utilis
Euonymus europaeus
ceriferus
Euonymus japonicus
ceriferus
Euonymus sp.
ceriferus
cirripediformis
rubens
Eupatorium "conchinum"
cirripediformis
Eupatorium sp.
cirripediformis
Euphorbia "hyperici"
cirripediformis
Euphorbia pulcherrima
cirripediformis
Eurotia lanata
irregularis
Eurya japonica
rubens
Fatsia japonica
ceriferus
rubens
Fatsia sp.
rubens
Feijoa sp.
sinensis
Feijoa sellowiana
cirripediformis
floridensis
"fern"
rubens
Ficus "rugosa"
ceriferus
Ficus sp.
dugesii
floridensis
rubens
Fortunella japonica
floridensis
Gardenia jasminoides
cirripediformis
floridensis
rubens
Gardenia sp.
ceriferus
cirripediformis
floridensis
rubens
Gaura "angustifolia"
cirripediformis
Grammatophyllum sp.
rubens
"gum elmi"
dugesii
Hedera helix
rubens
Helianthus sp.
rubens
Ilex aquifolium
ceriferus
cirripediformis
sinensis
Ilex cornuta
rubens
Ilex cornuta 'Burfordii'
ceriferus
floridensis
Ilex crenata 'Convexa'
ceriferus
Ilex crenata 'Microphylla'
sinensis
Ilex crenata 'Rotundifolia'
ceriferus
Ilex latifolia
ceriferus
Ilex opaca
ceriferus
Ilex serrata
ceriferus
Ilex vomitoria
ceriferus
floridensis
sinensis
Ilex sp.
brachyurus
rubens
Ipomoea batatas
cirripediformis
Ipomoea sp.
cirripediformis
Iva frutescens
cirripediformis
Ixora acuminata
nakaharai
Kadsura japonica
rubens
Lagerstroemia indica
ceriferus
Lauraceae
floridensis
sinensis
Laurus nobilis
floridensis
Laurus sp.
floridensis
"Leguminosae shrub"
sinensis
Lindera benzoin
floridensis
Litchi sp.
rubens
Loranthus "alyxifolius"
rubens
Loranthaceae
nakaharai
Magnolia salicifolia
rubens
Magnolia sp.
ceriferus
Mahonia sp.
ceriferus
Malpighia sp.
cirripediformis
Malus sp.
rubens
Malva sp.
dugesii
Mammea sp.
cirripediformis
Mangifera indica
floridensis
rubens
Mangifera sp.
rubens
Maytenus "buxifolia"
utilis
Maytenus sp.
cirripediformis
Melia azedarach
cirripediformis
Melia sp.
cirripediformis
Metrosideros collina
rubens
Metrosideros sp.
rubens

"Mistletoe"
cirripediformis
"Molineria recurrata"
rubens
"Monocota alliptica"
ceriferus
"Montanus" sp.
sinensis
"Mountain apple"
rubens
"Myrtle orange"
cirripediformis
Myrtus sp.
cirripediformis
floridensis
Nephelium lappaceum
ceriferus
Nerium oleander
dugesii
Palafoxia feayi
cirripediformis
"Palm"
rubens
Panda sp.
cistudiformis
Parkinsonia aculeata
cirripediformis
Parkinsonia sp.
cirripediformis
Parthenium sp.
cirripediformis
Passiflora edulis
cirripediformis
Passiflora ligularis
cirripediformis
Passiflora quadrangularis
cirripediformis
Passiflora sp.
cirripediformis
cistudiformis
Pellaea sp.
rubens
Pernettya sp.
floridensis
Persea americana
floridensis
Persea borbonia
floridensis
Persea sp.
ceriferus
Philodendron gigantium
rubens
Philodendron sp.
cirripediformis
Phoradendron flavescens
nakaharai
Pinus parviflora
rubens
Pinus sp.
rubens
Piper sp.
dugesii
Pisonia sp.
cirripediformis
Pittosporum sp.
ceriferus
rubens
Platanus sp.
floridensis
Pluchea "odorata"
cirripediformis
Podocarpus sp.
ceriferus
Podocarpus macrophyllus
ceriferus
Podocarpus nagi
ceriferus
Polypodium sp.
rubens
Porana paniculata
cistudiformis
Prunus salicina
floridensis
Prunus sp.
ceriferus
Psidium guajava
rubens
Psidium pomiferum
floridensis
Psidium sp.
cirripediformis
Punica granatum
cirripediformis
Punica sp.
floridensis
Pyracantha coccinea
ceriferus
Pyracantha sp.
ceriferus
Pyrus communis 'Sativa'
sinensis
Pyrus sp.
ceriferus
Rhizophora mangle
cirripediformis
rubens
Rhodomyrtus tomentosa
floridensis
rubens
"Rhus-like-shrub"
brachyurus
Rosaceae
floridensis
Rosmarinus sp.
cirripediformis
Salix sp.
cirripediformis
Sarracenia minor
floridensis
"Sauvagesia erecta"
ceriferus
Schinus molle
dugesii
sinensis
Schinus terebinthifolia
cirripediformis
Schinus sp.
cistudiformis
Spiraea sp.
ceriferus
Streptosolen jamesoni
sinensis
Streptosolen sp.
sinensis
Strobilanthes anisophyllus
cirripediformis
Syzygium jambos
floridensis
Syzygium sp.
sinensis
Tamarix gallica
ceriferus
Tamarix sp.
cirripediformis
nakaharai
Thevetia nereifolia
ceriferus
Trema mollis
dugesii
Tsuga canadensis
ceriferus
Tsuga sp.
ceriferus
Ulmus pumila
cirripediformis
Ulmus sp.
ceriferus
cirripediformis
Vaccinium arboreum
ceriferus
Vaccinium sp.
ceriferus
floridensis
Vanda "aurora"
cirripediformis
Viburnum sp.
rubens

GENERAL INDEX