SELECTED SCALE INSECT GROUPS (HEMIPTERA: COCCOIDEA) IN THE SOUTHERN REGION OF THE UNITED STATES

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ABSTRACT

This publication includes general discussions on the Conchaspididae, Diaspididae, Eriococcidae, Ortheziidae, Pseudococcidae, and Putoidae. Keys are presented for genera in the families Eriococcidae, Ortheziidae, and Pseudococcidae. Material for each family include introduction, field appearance, diagnosis, life history, important references, illustration of a slide-mounted adult female, and a checklist of the species occurring in the Southern Region of the United States and their distribution by state.

Key Words: scales, identification, southeastern United States

RESUMEN

Esta publicación incluye un discusión general de los Conchaspididae, Diaspididae, Eriococcidae, Ortheziidae, Pseudococcidae, y Putoidae. Las secciones para cada familia incluye una introducción, su apariencia en el campo, su diagnosis, la tabla de vida, referencias importantes, una ilustración de la hembra adulta montada en laminas de microscopio, una lista de las especies que ocurren en la Región sureste de los Estados Unidos y su distribución en cada Estado. Se incluye claves para los Eriococcidae, Ortheziidae, y Pseudococcidae.

Scale insects are phytophagous, feeding by sucking plant juices through a set of stylets. Individual species infest one or more or leaves, fruit, branches, main stems, trunks, or roots. They are widely distributed throughout the world with the exception of the cold extremes of the Arctic and Antarctic. They are found on a wide diversity or vascular plants, but only a few species are found on ferns and mosses. There is some debate about their rank in the classification system but they are considered by many authors to be part of the Order Hemiptera, Suborder Sternorrhyncha, Superfamily Coccoidea (Gullan 2001). The group includes about 7,300 species, 1,050 genera (Ben-Dov et al. 2002), and 20 or more families (especially if the margarodoids are divided into separate family units).

Scale insects are generally small, cryptic creatures that cause major problems in agricultural and ornamental ecosystems. They are commonly transported on plant materials and because of their small size and habit of feeding in concealed areas are frequent invasive species (Miller et al. 2005) causing billions of dollars in damage annually (Kosztarab 1990).

Scales are characterized by having a single claw, neotenic adult females, winged but non-feeding adult males, and an unusual form of metamorphosis that normally includes a prepupa and pupa in the adult male (Miller & Kosztarab 1979). Generally there are 3 or 4 instars in the female and 5 instars in the male. Most scale insects produce some kind of wax covering that may entail a mealy substance over the body or elaborate waxy structures that are attached to the body of the insect or are formed as domicile-like structures.

A list of families that occur in the Southern Region of the United States is given below. This, the splitters view of the Coccoidea, is becoming increasingly accepted in the discipline (Koteja 1974). Distribution records are those listed in ScaleNet (Ben-Dov et al. 2005) and have been supplemented with data from the Florida State Collection of Arthropods, Gainesville, FL and National Museum of Natural History, Beltsville, MD. Distribution records include established outdoor and greenhouse infestations, but do not include records of material taken in quarantine and destroyed.

1. Aclerididae (Flat grass scales)—small-sized family, worldwide 57 species
2. Asterolecaniidae (Pit scales)—moderate-sized family, worldwide 223 species
3. Cerococcidae (Ornate pit scales)—moderate-sized family, worldwide 72 species
4. Coccidae (Soft scales)—large-sized family, worldwide 1,130 species
5. Conchaspididae (False armored scales)—small-sized family, worldwide 29 species
6. Dactylopiidae (Cochineal scales)—small-sized family, native to new world 10 species
7. Diaspididae (Armored scales)—large-scale family, worldwide 2,300 species
8. Eriococcidae (Felt scales)—large-sized family, rare in the Oriental and Afrotropical areas 556 species

9. Kermesidae (Gall-like scales)—moderate-sized family, primarily from the northern hemisphere 90 species

10. Kerriidae (Lac scales)—moderate-sized family, worldwide 97 species

11. Kuwaniidae—small-sized margarodoid family, occurring under bark of hosts 8 species

12. Lecanodiaspididae (False pit scales)—moderate-sized family, worldwide 78 species

13. Margarodidae (Ground pearls)—moderate-sized margarodoid family, worldwide 108 species

14. Matsucoccidae (Pine bast scales)—small-sized margarodoid family on pines from Australia and the northern hemisphere 46 species

15. Monophlebidae (Giant scales)—moderate-sized margarodoid family, worldwide 255 species

16. Ortheziidae (Ensign scales)—moderate-sized family, worldwide 196 species

17. Pseudococcidae (Mealybugs)—large-sized family, worldwide 1,989 species

18. Putoidae (Giant mealybugs)—small-sized family, in all regions but Australasian and Afro-tropical areas 57 species

19. Xylococcidae—small-sized margarodoid family occurring in northern hemisphere and neotropical areas 11 species

Conchaspidae or False Armored Scales (Fig. 1)

False armored scales occur in all zoogeographic regions but probably are introduced in the Australasian and Palearctic regions. Madagascar seems to have the greatest diversity of species. There are 29 species in 4 genera worldwide; in the United States and in the Southern Region there are 3 species in 2 genera (Ben-Dov et al. 2002). Conchaspis angraeci Cockerell is widespread and may be introduced into the US, but Asceloconchaspis milleri Williams appears to be native to southern Florida.

Field Characters: Body hidden under thick wax cover similar to armored scale cover except exuviae not incorporated. Cover not attached to body, often volcano shaped with ridges radiating from scale apex; round or oval in outline. Some covers without conical top, but usually with ridges. Cover of most species white or dirty white. Female body usually white (Mamet 1954) deep red or purple in Conchaspis cordiae (F. William Howard, pers. comm., May 2005).

Diagnosis: Posterior abdominal segments coalesced into pygidium; legs present in all but 1 species; trochanter and femur fused; tibia and tarsus fused; antennae 3- to 5-segmented; ocellar spot on head; 2 genera with metathoracic sclerotizations near hind coxae.

Hosts: Conchaspidids are frequently collected on trees and woody perennials, but they also are found on orchids, euphorbias, and palms.

Life History: False armored scales have 4 female instars and 5 in the male (Miller 1991b). First instars settle on the host but do not produce a cover until the first molt. They usually settle on the leaves or branches of the host.

Important references: Ben-Dov (1974); Ben-Dov (1981); Mamet (1954); Mamet (1959); Williams (1985a); Williams (1992).

Checklist of false armored scales of the Southern Region (asterisk signifies a commonly collected species)

Asceloconchaspis milleri Williams FL
*Conchaspis angraeci Cockerell FL, PR
Conchaspis cordiae Mamet FL, PR.

Diaspididae or Armored Scale Insects (Figs. 2, 3)

Armored scales are the most speciose family of scale insects including about 2,369 species in 380 genera (Ben-Dov et al. 2002). Although there are several classifications of the Diaspididae, there are two groups that contain a majority of the species and are relatively easy to recognize. They often are used as informal groups and are referred to as diaspidines and aspidiotines; they are based on two of the major subfamilies of armored scales, the Diaspidinae and Aspidiotinae (Ferris 1942). There are no obvious characters that separate these groups all of the time, but most species are consistent with the following combination of characters. Diaspidines produce an elongate scale cover and have two-barred macroducts, more than one seta on each antenna, gland spines between the pygidial lobes, bilobed second lobes, and pores near the spiracles. Aspidiotines produce an oval or round cover and have one-barred macroducts, one seta on each antenna, plates between the pygidial lobes, simple second lobes, and no pores near the spiracles.

Field Characters: Wax covering domicile-like, not attached to body; wax covering with exuviae of 1 or 2 immature instars incorporated and usually visible; cover formed of wax manipulated by pygidium, of solid consistency, not filamentous or powdery; often with ventral cover; body elongate or oval; body color white, yellow, purple, red, or orange; occurring on nearly any part of plant, rare on roots and rootlets; some species become buried under plant epidermis.

Diagnosis: Posterior abdominal segments coalesced into wax-forming structure called pygidium; generally with lobes and plates or gland spines on pygidium; legs absent or represented by small sclerotized area; antennae represented by unsegmented knob; labium 1-segmented.
Host plants: Armored scales occur on a variety of host plants encompassing more than 1,380 plant genera in 182 plant families (compiled from Borchsenius 1966). The most prevalent host families are: Fabaceae with about 230 species of armored scales, Poaceae with about 150 species, and

Fig. 1. Conchaspis angraeci Cockerell: Illustration from Gill (1993).
Euphorbiaceae with 145 species. armored scales usually are pests on plants that survive for more than a single year including fruit and nut crops, forest trees, and ornamentals such as landscape perennials, shrubs, shade trees, and greenhouse plants. Miller and Davidson (1990) compiled a list of 199 species that are considered pests in at least some part of the world. This figure is only about 8% of the total number of described species and their economic impact is quite significant.

Life History: Diaspidids have 3 female instars and 5 male instars (Miller 1991b). Life histories are quite diverse; there can be from 1 to 6 or more generations each year and overwintering can be in any instar except the third, fourth, or adult male. Second instars and mated adult females are probably the most common. In many species, the number of generations and overwintering stages can vary depending on the climate. Eggs or first instars (=crawlers) are laid under the scale cover and a small slit is present at the posterior end of the cover that allows the crawlers egress to the outside. Scale cover formation is an interesting process that usually involves the incorporation of the crawler and second-instar exuviae. Several groups are pupillarial, i.e., the adult female remains inside of the hardened second instar exuviae. Dispersal is undertaken by the first-instar crawler either passively by air movement or actively by crawling. The first instar is the only life stage that has legs with the exception of the third, fourth, and adult male. Males only incorporate the shed skin of the crawler into their cover; the exuviae of the other instars are kicked posteriorly in the cover (Miller & Davidson 2005).

Important references: Balachowsky (1948, 1950, 1951, 1953, 1954); Ben-Dov & German (2003); Borchsenius (1966); Danzig (1993); Ferris (1937, 1938, 1941, 1942); Howard & Oliver (1985); Miller & Davidson (2005); Miller & Gimpel (2005); Tang (1986).

Checklist of Armored Scales of the Southern Region (asterisk signifies a frequently collected species)

**Abgrallaspis colorata** (Cockerell) FL, NC, SC, TX
*Abgrallaspis cyanophylli* (Signoret) FL, GA, LA, MS, PR, TX
**Abgrallaspis ithace** (Ferris) GA, TN, VA
**Abgrallaspis liroidendri** Miller and Howard LA
**Abgrallaspis persea** Davidson GA, TX
**Acutaspis agavis** (Townsend and Cockerell) FL, TX
**Acutaspis albopicta** (Cockerell) TX
**Acutaspis aliena** (Newstead) FL, PR
*Acutaspis morrisonorum* Kosztarab AL, AR, FL, GA, LA, NC, PR, TN, VA
**Acutaspis persea** (Comstock) AL, FL, GA, LA, MS, SC, TN, TX
**Acutaspis scutiformis** (Cockerell) TX
**Ancepsaspis tridentata** (Ferris) TX
**Andaspi hawaiensis** (Maskell) FL
**Andaspi mackieana** (McKenzie) FL
**Andaspi punicea** (Laing) FL
**Annulaspis polygona** Ferris TX
**Aonidia atlantica** Ferris AL, FL, GA
**Aonidia shastae** (Coleman) TX
*Aonidiella auranti (Maskell) FL, LA, MS, PR, TX
*Aonidiella citrina* (Coquillett) FL, TX
**Aonidiella comperei** McKenzie PR
**Aonidiella inornata** McKenzie PR, TX
**Aonidiella orientalis** (Newstead) FL, PR
*Aonidiella taxus* Leonardo AL, FL, GA, LA
*Aonidomytilus albus* (Cockerell) TX
**Aonidomytilus conceor** (Cockerell) TX
**Aonidomytilus crookie** (Ferris) FL, GA, VA
*Aonidomytilus hyperci** Ferris GA, FL, LA, MS, NC, VA
**Aonidomytilus peninsularis** (Ferris) TX
**Aonidomytilus sabotius** Tippins AL, GA
*Aonidomytilus solidaginis* (Hoke) AL, FL, GA, LA, MS, SC, TN, VA
**Apolaspis gainsi** McDaniel TX
**Aspidiella hartii** (Cockerell) PR
*Aspidiella sacchari* (Cockerell) FL, PR, TX
*Aspidiotus destructor* Signoret FL, GA, PR
**Aspidiotus excisus** Green FL, PR
**Aspidiotus marcisi** AL, FL, GA
*Apidiotus nerii* Boucê AL, FL, GA, LA, MS, PR, TX
*Aulacaspis rosae* Boucê AL, FL, GA, LA, PR, SC, VA
*Aulacaspis tubercularis* Newstead FL, PR
*Aulacaspis yasumatsui* Takagi FL, PR
**Carulaspi juniperi** Boucê GA, VA
**Carulaspi minima** (Signoret) AL, FL, GA, LA, NC, TN, TX, VA
**Chionaspis acericola** Hollinger GA, NC, TX
*Chionaspis americana* Johnson FL, GA, LA, MS, TN, VA
**Chionaspis caray Cooley FL, LA, NC, VA
Chionaspis corni Cooley LA, VA
**Chionaspis eurora** Leonard FL
**Chionaspis floridensis** Takagi FL
*Chionaspis furfura* (Fitch) FL, GA, KY, LA, MS, NC, TN, TX, VA
*Chionaspis gleditsiae* Sanders FL, LA, MS, NC, TN, TX, VA
**Chionaspis hamboni** Liu and Kosztarab FL
**Chionaspis heterophyllae** Cooley AL, FL, GA, LA, MS, NC, TN
**Chionaspis kozatari** Takagi and Kawai FL, GA, MS, NC, TN, VA
**Chionaspis longioboa** Cooley AL, AR, FL, LA, TX
**Chionaspis nyssae** Comstock AL, FL, GA, LA, MS, NC, SC, TX, VA
**Chionaspis pinifoliase** (Fitch) AL, FL, GA, LA, TN, TX, VA
**Chionaspis platanii** Cooley LA, NC, TX, VA
*Chionaspis saliscpis* (Linnaeus) AL, AR, FL, LA, MS, NC, TN, TX, VA
**Chionaspis styracis** Liu and Kosztarab FL
Chionaspis triformis Tippins and Beshar FL, GA
**Chortinaspis cottani** McDaniel TX
**Chortinaspis divaricata** Ferris FL, GA
Chortinaspis frankliniana Ferris TX
**Chortinaspis graminella** (Cockerell) FL, GA, TX
Chortinaspis subheortina (Laing) FL, MS, TX
*Chrysomphalus aonidium* (Linnaeus) AL, FL, GA, LA, MS, PR, TX
*Chrysomphalus bifasciculatus* Ferris AL, GA, LA, NC, SC, TX, VA
*Chrysomphalus dictyospermi* (Morgan) FL, GA, LA, MS, PR, TX
Fig. 2. Diaspidinae—*Lepidosaphes pallida* (Maskell): Unpublished illustration by Davidson.
<table>
<thead>
<tr>
<th>Species</th>
<th>References and Locations</th>
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<td><em>Clavaspis herculanea</em> (Cockerell and Hadden) FL, PR, TX</td>
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<td><em>Clavaspis ulmi</em> (Johnson) GA, LA, MS, SC, TX, VA</td>
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<tr>
<td><em>Houdaria biclavis</em> (Comstock) FL</td>
<td></td>
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<tr>
<td><em>Ischneaspis longirostris</em> (Signoret) FL, GA, LA, PR</td>
<td></td>
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<tr>
<td><em>Kuwanaaspis higosaki</em> (Kuwana) FL, GA</td>
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<tr>
<td><em>Kuwanaaspis houardi</em> (Cooley) FL, GA, LA</td>
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<tr>
<td><em>Kuwanaaspis linearis</em> (Green) PR</td>
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<tr>
<td><em>Kuwanaaspis pseudoleuaspis</em> (Kuwana) AL, FL, GA, LA, SC</td>
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<tr>
<td><em>Kuwanaaspis verniformis</em> (Takahashi) FL</td>
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<tr>
<td><em>Lepidosaphes beckii</em> (Newman) FL, GA, LA, MS, PR, TN, TX</td>
<td></td>
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<tr>
<td><em>Lepidosaphes boguschii</em> McDaniel TX</td>
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<tr>
<td><em>Lepidosaphes camelliae</em> Hoke FL, GA, LA, MS, SC, TX, VA</td>
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<tr>
<td><em>Lepidosaphes conchiformis</em> (Gmelin) PR</td>
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<tr>
<td><em>Lepidosaphes gloverii</em> (Packard) AL, FL, LA, MS, PR, SC, TX</td>
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<td><em>Lepidosaphes lasiantii</em> (Green) PR</td>
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<tr>
<td><em>Lepidosaphes neuensteadi</em> (Sulc) FL, MS</td>
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<tr>
<td><em>Lepidosaphes pulchella</em> (Maskell) FL, GA, LA, MS, VA</td>
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<td><em>Lepidosaphes pinnaeformis</em> (Bouché) FL</td>
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<tr>
<td><em>Lepidosaphes rubrotincta</em> Cockerell PR</td>
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<td><em>Lepidosaphes tokiwaniana</em> (Kuwana) MS, PR</td>
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<tr>
<td><em>Lepidosaphes ulmi</em> (Linnaeus) FL, GA, LA, NC, TN, VA</td>
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<td><em>Lepidosaphes vermiculis</em> Mameit PR</td>
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<tr>
<td><em>Lepidosaphes yanagicola</em> Kuwana GA, TN, VA</td>
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<tr>
<td><em>Lopholeucaspis cockerelli</em> (Grandpre and Charmoy) FL, PR, Lindingaspis floridana Ferris FL</td>
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<tr>
<td><em>Lopholeucaspis japonica</em> (Cockerell) VA</td>
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<tr>
<td><em>Melanaspis arundinariae</em> Deitz and Davidson SC</td>
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<tr>
<td><em>Melanaspis bronchiae</em> (Leonardi) FL, PR</td>
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<tr>
<td><em>Melanaspis cucolorobae</em> Ferris FL, PR</td>
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<tr>
<td><em>Melanaspis dekei</em> Deitz and Davidson FL, GA</td>
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<tr>
<td><em>Melanaspis delicata</em> Ferris TX</td>
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<tr>
<td><em>Melanaspis deliquescentis</em> Ferris TX</td>
<td></td>
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<tr>
<td><em>Melanaspis elegans</em> McKenzie LA, TX</td>
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<tr>
<td><em>Melanaspis jasminea</em> Ferris FL, GA</td>
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<tr>
<td><em>Melanaspis latipinnia</em> Ferris TX</td>
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<tr>
<td><em>Melanaspis lilacina</em> (Cockerell) TX</td>
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<tr>
<td><em>Melanaspis marlatti</em> (Parrott) FL, GA, TX</td>
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</tbody>
</table>
*Odonaspis minima* McKenzie FL, PR

Parlatoria proteus (Curtis) FL, GA, LA, MS, NC, SC, TX, VA

Pseudoparlatoria pseudaspera (Zehntner) AL, FL, GA, LA, MS, NC, SC, TX, VA

**Anaspis** spumigera (Zehntner) AL, FL, GA, LA, MS, NC, SC, TX, VA

Melanaspis mimosae (Comstock) FL

Melanaspis nigropunctata (Cockerell) PR, TX, VA

*Melanaspis obscura* (Comstock) AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, TX, VA

Melanaspis odontoglossi (Cockerell) FL, PR

Melanaspis pseudoponderosa Deitz and Davidson FL

Melanaspis texana (Cockerell) FL, GA, LA, MS, NC, SC, TX, VA

Melanaspis tenax McKenzie FL, PR

*Melanaspis tentricosa* (Comstock) AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, TX, VA

*Morganella curoenensis* (Cockerell) FL, GA, LA, MS, SC, TX

Morganella longispina (Morgan) FL, PR

Myctetaspis apicata (Newstead) TX

Myctetaspis defunctulus Ferris FL, TX

Myctetaspis personata (Comstock) FL, PR

Myctetaspis sphaerioides (Cockerell) LA

Neopinnaspis harperi McKenzie FL, GA

Niveaspis ilicis (Hokey) GA, MS, TX

Oceanaspisridia araucariae (Adachi and Fullaway) FL, PR

*Oceanaspisidiothes spinosus* (Comstock) AL, FL, GA, LA, MS, PR, TX

Odonaspis benardi Balachowsky TX

Odonaspis floridana Ben-Dov FL

Odonaspis litorosa Ferris TX

Odonaspis minima Howell and Tippins GA

*Odonaspis ruthae* Kotinsky AL, AR, FL, GA, LA, MS, NC, PR, SC, TX

Odonaspis saccharicaulis (Zehntner) AL, FL, PR, TX

Odonaspis secretas (Cockerell) LA

Odonaspis texana Ben-Dov TX

Opuniaspis carinata (Cockerell) FL

Opuniaspis javanensis Green FL

Pulanaspis quohogiformis (Merrill) FL, PR

Parlatoria chinesis (Marlatt) FL, PR

*Parlatoria camelliae* Comstock FL, GA, LA, MS, NC, SC, TX, VA

Parlatoria cinerea Hadden PR

Parlatoria crotonis Douglas FL, LA, PR

*Parlatoria perangdii* Comstock FL, GA, LA, MS, NC, PR, SC, TX, VA

*Parlatoria proteus* (Curtis) FL, GA, LA, MS, PR, TN, TX

Parlatoria pseudopatioiditas Lindinger FL, PR, TN

Parlatoria theae Cockerell GA, NC, TX, VA

Parlatoria ziziph (Lucas) FL, PR

Pellucaspis celtis McDaniel TX

*Pinnaspis apsidiformes* (Signoret) AL, AR, FL, GA, KY, LA, MS, NC, PR, SC, SC, TN, TX, VA

Pinnaspis buxi (Bouché) FL, PR

*Pinnaspis strachani* (Cooley) AL, FL, GA, LA, MS, PR, TX

Praecocaspis diversa Ferris FL

Protodiaspis emory Ferris TX

Protodiaspis lobata Ferris TX

Protodiaspis vara Hoke AR, MS, TN, TX

*Pseudonodiola duplex* (Cockerell) AL, FL, GA, LA, MS, NC, SC, TX, VA

*Pseudonodiola paenaei* (Cockerell) AL, AR, FL, GA, LA, MS, NC, SC, TX, VA

Pseudoaspididae (Green) FL, PR

*Pseudouaspidias cokerelli (Cooley) AL, FL, GA, LA, SC, TN, TX, VA

*Pseudouaspidias pentagona* (Targioni Tozzetti) AL, FL, GA, LA, MS, NC, PR, SC, TN, TX, VA

*Pseudouaspidias pruniloca* (Maskell) AL, FL, LA, MS, NC, VA

Pseudischaspis boweryi (Cockerell) FL, PR

Pseudoloparatoria ostreata Cockerell FL, PR

*Pseudoloparatoria parlatorioidea* (Comstock) AL, FL, GA, PR, SC, TX

Pseudoloparatoria tillandsiae Tippins FL, GA, SC

Quernaspis insularis Howell AR, FL, GA, LA, TX

Quernaspis quercicola Tippins and Beshear GA

*Quernaspis quercus* (Comstock) FL, LA, FL, PR, TX

Radionaspis indica (Marlatt) FL, PR

*Rhizaspisidiotus dearnessi* (Cockerell) AL, FL, GA, NC, SC, TX, VA

Rutherfordia florigera (Cockerell) FL, PR

Selenaaspis articulatus (Morgan) FL, PR

Situlaspis condalialae (Ferris) TX

Situlaspis yuccae (Cockerell) FL, TX

Stramenaspis kelloggi (Coleman) TX

Tugonia bigeloviae (Cockerell) TX

Tugonia yucauram (Cockerell) TX

Thysanofiorinia nepelii (Maskell) FL

*Unaspis citri* (Comstock) AL, FL, GA, LA, MS, PR, VA

*Unaspis euonymi* (Comstock) AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, TX, VA

Velataspis anasterias Ferris TX

Velataspis dentata (Hoke) AL, FL, GA, LA, MS, TN, TX

Velataspis mimosaarum (Cockerell) TX

Vinculaspir virgata (Ferris) PR

Xerophilaspis prosopidis (Cockerell) TX

Eriococcidae or Felt Scales (Fig. 4)

Felt scales occur in all zoogeographic regions but have very poor representation in the Afrotropical and Oriental regions and are very abundant in New Zealand and Australia. There are 542 species in 69 genera; in the United States there are 80 species in 10 genera; in the Southern Region including Puerto Rico there are 49 species in 7 genera (Ben-Dov et al. 2002). Several species are occasional pests in the Southern Region including *Eriococcus azaleae* on azaleas, *E. cocinea* on cactus especially *Mammillaria, E. quercus* on oaks, and *E. spurius* on elms.

Field Characters: Felt scales are very diverse and comprise a number of apparently unrelated groups (Cook et al. 2002). The most common eriococcids in the U.S. are those of the *Eriococcus* type. They produce a white, gray, or yellowish ovisac that encloses the pyriform body of the adult female. Body color varies from pink or red to purple, green, or brown. The posterior end of the sac has a small opening that allows the first instars to escape. Other eriococcids occur under the bark of the cactus especially *Mammillaria, E. quercus* on oaks, and *E. spurius* on elms.

Diagnosis: Because of the great diversity and lack of monophyly of this family (Cook et al. 2002) there is no single diagnostic character. Characters that often are present on felt scales include: microtubular ducts; strongly protruding anal lobes; conical setae; cruciform pores; translucent pores on hind legs (Miller & McKenzie 1967).
Hosts: Eriococcids occur on a wide diversity of hosts including trees, shrubs, and even grasses. They are found on all parts of the host with the possible exception of small diameter rootlets. The greatest diversity in the southern hemisphere is on older families such as the Myrtaceae whereas
in the northern hemisphere they are most diverse on more advanced plant groups such as the Asteraceae (Hoy 1962; Miller 1969).

Life History: Felt scales have 3 instars in the female and 5 in the male (Miller 1991b). Most eriococcus-type species have 1 or 2 generations each.

Fig. 4. Eriococcus sp.: Unpublished illustration by Miller.
year. The overwintering stage usually is the adult female or egg in the ovisac. First instars appear in early spring and settling often occurs within hours of emergence from the ovisac. Second-instar males feed for a short period then produce a narrow felt sac that encloses the body. Development of the prepupa, pupa, and adult male occurs within this sac. Soon after molting, the adult female mates and produces the ovisac several days later. Usually 50 to 100 eggs are laid. Some eriococcids have very unusual life histories. One example is the gall-inducing genus *Apiomorpha* which can have females that live for a year or more and produce separate male galls that often are induced on the gall of the female (Cook 2001; Cook & Gullan 2002).

Important references: Cook (2001); Cook et al. (2002); Ferris (1955); Gill (1993); Gullan (1984); Hoy (1962, 1963); Miller & Gimpel (2000).

**KEY TO GENERA OF ERIOCOCCIDAE OF THE EASTERN U.S. (ADULT FEMALES)**

**(MODIFIED FROM MILLER & MILLER 1993b)**

1. Legs present ................................................................. 2
   Legs absent or represented by vestiges .................................. Cryptococcus Douglas

2(1). Anal lobes present ......................................................... 4
   Anal lobes absent .......................................................... McCord's scale

3(2). Macrotubular ducts present; without conspicuous dermal projections along body margin . . . Ovaticoccus Kloet
   Macrotubular ducts absent; with conspicuous dermal projections along body margin ................................... Hypericicoccus Williams

4(2). Anal lobes sclerotized, with enlarged setae; anal ring with 4 pairs of setae .............. Eriococcus Signoret
   Anal lobes unsclerotized, without enlarged setae; anal ring with 3 pairs of setae ............... Oregmopyga Hoy

Checklist of Felt Scales of the Southern Region (asterisk signifies a frequently collected species)

*Apezooccus idastes* Ferris TX
*Cornocalus cornutus* Ferris TX
*Cryptococcus fagusuga* Lindinger TN, VA
*Cryptococcus williamsi* Kosztarab VA
*Eriococcus actius* (Miller and Miller) FL, GA
*Eriococcus arauacariae* Maskell FL, TX, PR
*Eriococcus arenariae* (Miller and Miller) SC
*Eriococcus arenosus* Cockerell TX
*Eriococcus azaleae* Comstock AL, AR, FL, GA, LA, MS, NC, SC, TN, TX, VA
*Eriococcus besheareae* (Miller and Miller) FL, GA, SC
*Eriococcus boguschi* McDaniel TX
*Eriococcus caroliniae* Williams NC, VA
*Eriococcus chilos* (Miller and Miller) VA
*Eriococcus coccineus* Cockerell FL, TX, VA
*Eriococcus cryptus* Cockerell TX
*Eriococcus davidsoni* (Miller and Miller) FL
*Eriococcus dennoi* (Miller and Miller) AL, FL, GA, SC, VA
*Eriococcus droserae* (Miller, Liu, and Howell) FL, GA
*Eriococcus dubius* Cockerell AL, TX
*Eriococcus ehrongi* Ehrhorn FL
*Eriococcus euphoriae* Ferris TX
*Eriococcus gerbergi* McDaniel TX
*Eriococcus howelli* (Miller and Miller) FL, GA, SC, VA
*Eriococcus hoyi* (Miller and Miller) TX
*Eriococcus kemptoni* Parrott AL, GA, MS, TX, VA
*Eriococcus larraeae* Parrott and Cockerell TX
*Eriococcus leptoporus* (Miller and Miller) GA
*Eriococcus megaporus* (Miller and Miller) FL, GA, SC, VA
*Eriococcus mesotrichus* (Miller and Miller) FL, GA, LA, SC
*Eriococcus microtrichus* (Miller and Miller) TX
*Eriococcus missouri* Hollinger GA, LA, MS, VA
*Eriococcus monotrichus* (Miller and Miller) FL, GA
*Eriococcus nudulus* (Ferris) TX

*Eriococcus oligotrichus* (Miller and Miller) GA
*Eriococcus ophius* (Miller and Miller) FL, GA
*Eriococcus quercus* (Comstock) AL, FL, GA, LA, MS, TX, VA
*Eriococcus smithi* Lobell FL, GA, LA, MS, SC, TX
*Eriococcus sparius* (Modeer) AL, AR, LA, TN, TX, VA
*Eriococcus stellatus* McDaniel TX, VA
*Eriococcus texanus* King TX
*Eriococcus tisexleyi* TX
*Eriococcus tosotrichus* (Miller and Miller) GA
*Hypericicoccus hyperici* (Ferris) AL, FL, GA, TN
Oregmopyga neglecta (Cockerell) TX
Oregmopyga parvispina (Chaffin) FL, TX
Oregmopyga straphyla Miller and Miller GA
Oregmopyga tippinsi Miller and Miller AL, FL, GA, MS
*Ovaticoccus adoxus* Miller and Miller TX
*Ovaticoccus agavium* (Douglas) TX

Ortheziidae or Ensign Scales (Fig. 5)

Ensign scales occur in all zoogeographic regions of the world. There are 198 species and 20 genera worldwide; in the United States there are about 30 species in 7 genera; and in the Southern Region there are 17 species in 6 genera (Ben-Dov et al. 2002).

Field Characters: Adult females with a thick wax ovisac that is attached to the abdomen and not the host; body adorned with patches of thick wax giving an ornate, elegant appearance; legs and antennae large and dark (Kozár 2004).

Diagnosis: Anal ring on dermal surface, with pores and setae; apex of antenna with thick terminal seta; abdominal spiracles present; eyes stalked; predominant pore type quadrilocular; usually with ovisac band around perimeter of ventral abdomen (Kozár 2004).
Hosts: Ortheziids occur on a broad diversity of host plants ranging from mosses and fungi to grasses and woody shrubs, even on small herbaceous plants (Morrison 1925, 1952).

Life History: Ensign scales have 4 instars in the female and most likely 5 instars in the male (Miller 1991b). It is unknown if the prepupa is mobile like most margarodoid groups or is seden-
tary like other scale insects. The life history of these scales is not well described. In the greenhouse on coleus, Orthezia insignis (Browne) could complete a complete life cycle in 30 days and reproduction was strictly parthenogenetic. Offspring were deposited over 24 days and from 80-102 nymphs were produced per female (Shivakumar & Lakshmikantha 2001). Normally feeding on the foliage of the host.

Important References: Kozár (2004); Miller et al. (2005); Morrison (1925, 1952).

Notes: In 2004, a book was completed on the Ortheziidae of the world by Ferenc Kozár. Many new genera and species are included from most areas of the world. The Orthezia species groups used by Morrison (1952) are now treated as genera, e.g., the graminis species group is now Graminorthezia, so the number of described genera has nearly doubled.

Checklist of Ensign Scales (Ortheziidae) of the Southern Region (asterisk signifies a commonly collected species)

- Graminorthezia pseudograminis (Morrison) TX
- Graminorthezia tillandsiae (Morrison) FL, GA, LA, VA
- Insignorthezia caictiola (Morrison) TX
- *Insignorthezia insignis* (Browne) FL, PR, TN, VA
- Insignorthezia pseudinsignis Morrison LA, TX
- Newsteadia americana Morrison SC, VA
- Newsteadia floridensis Kozár and Koncz Benedecty FL
- *Newsteadia minima* Morrison FL, GA, NC, VA
- Newsteadia trisegmentalis Howell FL, GA
- *Nipponorthezia obscura* Morrison FL, SC, TX, VA
- Orthezia ambrosioides (Morrison) TX
- Orthezia annae Cockrell TX
- Orthezia graminicolora Morrison GA, MS
- Orthezia solidaginis Sanders GA, VA
- Praelongorthezia chisosi Morrison TX
- Praelongorthezia gynnomolae (Morrison) TX
- Praelongorthezia praelonga Douglas PR

### Key to Ensign Scale Genera in the Southern Region

<table>
<thead>
<tr>
<th>1. Tibiae and tarsi separate</th>
<th>1. Tibiae and tarsi fused</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Antennae 3- or 4-segmented; first 2 segments smaller or equal to other segments</td>
<td>2</td>
<td></td>
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<tr>
<td>Nipponorthezia</td>
<td>Newsteadia</td>
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<tr>
<td>3. With rows of setae inside of ovisac band</td>
<td>Without rows of setae inside of ovisac band</td>
<td>4</td>
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<tr>
<td>Insignorthezia</td>
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<tr>
<td>5. Head without dorsal sclerotized plates</td>
<td>Head with dorsal sclerotized plates</td>
<td>5</td>
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<tr>
<td>Praelongorthezia</td>
<td></td>
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<tr>
<td>5(4). 7 or fewer pairs of abdominal spiracles</td>
<td>8 pairs of abdominal spiracles</td>
<td>6</td>
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<tr>
<td>Graminorthezia</td>
<td></td>
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<tr>
<td>Orthezia</td>
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### Pseudococcidae or Mealybugs (Fig. 6)

Mealybugs occur in all zoogeographic regions of the world and are abundant in most ecosystems. There are 1,989 species and 271 genera worldwide; in the United States there are 351 species in 48 genera; and in the Southern Region there are 155 species and 37 genera (Ben-Dov et al. 2002).

**Field Characters:** Adult females are often characterized by a white, mealy or powdery secretion that covers the body. Species that occur in concealed habitats such as grass sheaths either lack this secretion or have only small amounts of it. Frequently marginal areas of the body have a series of protruding lateral wax filaments. These filaments may be absent, confined to the posterior 1 or 2 abdominal segments, or occur around the entire body perimeter. A filamentous secretion often is produced that encloses the eggs and at least part of the body (McKenzie 1967).

**Diagnosis:** Look for the following combination of characters; none are present in all species. With ostioles; cerarii, when present, usually present at least on anal lobe; 1 or more circuli; swirled-type trilocular pores; translucent pores on hind legs; 2 pores on each surface of trochanter; without basal denticle on claw. Other characters to consider are: trochanter pores parallel to front edge of femur, not oriented transversely; 3 labial segments; usually 3 pairs of anal-ring setae; more than 4 setae on tibia; tubular ducts without invagination (Williams 2004; Miller et al. 2005).

**Notes:** No single character can be used to determine a specimen as a pseudococcid. Mealybugs are a large and diverse group and exceptions occur for every character. There are species without ostioles, cerarii, circuli, trilocular pores, and translucent pores. Although the family is distinct, the only way that it can be diagnosed is by using a combination of characters (Danzig 1986).

**Hosts:** Based on an analysis of the host information in the mealybug catalogue by Ben-Dov (1994), mealybugs occur on species in about 250 families of host plants. The most common host family is Poaceae with 585 species. The Asteraceae is a distant second with 250 species. The top ten most common host families are Fabaceae 225; Rosaceae 116; Rubiaceae 101; Euphorbiaceae 97; Myrtaceae 94; Labiatae 85; Moraceae 82; Cyperaceae 75. It is interesting that grasses and composites are such...
important hosts of mealybugs, but are far less common as hosts of armored scales. This might be explained by the tendency for mealybugs to occur on herbaceous plants rather than woody plants. There are surprisingly few mealybugs on families such as Salicaceae, Pinaceae, and Betulaceae.

Fig. 6. *Pseudococcus maritimus* (Ehrhorn): Illustration from Miller, Gill, and Williams (1984).
Life History: Mealybugs have 4 female instars and 5 instars in the male (Miller 1991b). Mealybugs have a diverse array of life history strategies from occurring in grass blade sheaths, to feeding on rootlets, to occurring exposed on leaves. Thus any generalized life history will have many exceptions. Many mealybugs overwinter as second instars, although adults, first instars, and eggs also can play this role. Eggs or first instars are laid by the adult female. Eggs are normally laid in an ovisac that can enclose all or part of the body of the female. Most species that lay first instars rather than eggs lack any substantial ovisac. Even though the majority of species have legs in all instars, most mealybugs remain relatively stationary throughout their life; a few species such as members of the genus *Phenacoccus*, move to different areas of the host for overwintering, feeding, oviposition, and molting. Most species have 1 or 2 generations a year, although some are reported to have as many as 8 generations in the greenhouse. Both parthenogenetic and sexual species are common (McKenzie 1967).

Important references: Ben-Dov (1994); Ben-Dov & German (2005); Danzig (1986); Ferris (1950, 1953); Tang (1992); Williams & Watson (1988); Williams & Granara de Willink (1992); Williams (1985b, 2004).

### KEY TO SLIDE-MOUNTED ADULT FEMALE MEALYBUG GENERA IN THE SOUTHERN REGION

1. Trilocular pores abundant ................................................................. 6
   Trilocular pores absent or rare ..................................................... 2

2(1). Quinquelocular pores present ...................................................... 3
   Quinquelocular pores absent .......................................................... 4

3(2). With a few trilocular pores near spiracles .................................... 5
   Without trilocular pores ............................................................... *Brevennia*

4(2). Posterdorsal setae filamentous, not enlarged .................................. 5
   Some posterdorsal setae enlarged, similar in shape to cerarian setae ........ *Hypogecoccus*

5(4). Pores in spiracular atria .................................................................. 5
   Pores absent from spiracular atria .................................................. *Miscanthicoccus*

6(1). Legs present .................................................................................. 9
   Legs absent ....................................................................................... 7

7(6). Small pores or ducts in cluster posterior of hind spiracle .................. 8
   Small pores absent from area posterior of hind spiracle ....................... *Antonina*

8(7). Anal ring at end of invaginated tube; anal ring setae longer than diameter of anal ring ................................................... *Chaetococcus*
   Anal ring on dorsal surface, not in a tube; anal ring setae shorter than diameter of ring ........................................... *Paludicoccus*

9(6). Antennae not geniculate or elbowed; normally not on rootlets of host ...... 11
   Antennae geniculate; usually on rootlets of host .................................. 10

10(9). Apex of body with 2 spines; head also with 2 spines ......................... *Geococcus*
   Apex of body and head without spines ............................................. *Rhizoecus*

11(9). Legs well developed, longer than clypeolabral shield plus labium ......... 15
   Legs small; front legs about same length or shorter than clypeolabral shield plus labium ........................................ 12

12(11). Without circuli ............................................................................. 13
   With circuli ....................................................................................... *Radicoccus*

13(12). Hind coxae not enlarged, without translucent pores ......................... 14
   Hind coxae greatly enlarged, with numerous translucent pores ............ *Pseudantonina*

14(13). Anal ring without pores .................................................................. 16
   Anal ring with many pores .................................................................. *Antoninoides*

15(11). Anal ring with pores ........................................................................ 16
   Anal ring without pores ..................................................................... *Humococcus*

16(15). Claw without a denticle .................................................................. 20
   Claw with a denticle ......................................................................... 17

17(16). Dorsal tubular ducts without a sclerotized orifice ............................ 18
   Some dorsal tubular ducts protruding and with sclerotized orifices ........ *Heliococcus*

18(17). Dorsal setae conical or filamentous ................................................ 19
   Some dorsal setae enlarged, often truncate, with cluster of basal trilocular pores ............................................ *Stemmatomerinx*
Fig. 7. *Puto kosztarabi* Miller and Miller: Illustration from Miller and Miller (1993).
19(18). Dorsal tubular ducts without clusters of multilocular pores surrounding orifice. .......... *Phenacoccus*
   Dorsal tubular ducts with clusters of multilocular pores surrounding orifice. .......... *Peliococcus*

20(16). Without oral-rim tubular ducts ...................................................... 28
   With oral-rim tubular ducts .............................................................. 21

21(20). With multilocular pores at least near vulva .................................... 22
   Without multilocular pores .............................................................. 21

22(21). With more than 6 pairs of cerarii ................................................. 25
   With 6 or fewer pairs of cerarii ...................................................... 21

23(22). Oral-rim tubular ducts without associated setae, usually without sclerotization around rim .......... *Ferrisia* (in part)
   Oral-rim tubular ducts with associated setae and heavy sclerotization around rim .. *Ferrisia* (in part)

24(23). Anal bar present; dorsal setae nearly as long as ventral setae ................. *Maconellicoccus*
   Anal bar absent; dorsal setae conspicuously shorter than ventral setae .......... *Chorizococcus*

25(22). Anal bar present ............................................................... 26
   Anal bar absent ................................................................. 27

26(25). 18 pairs of cerarii ................................................................. 28
   17 or fewer pairs of cerarii ............................................................ 27

27(25). Auxiliary setae present in cerarii other than anal-lobe pair ............... *Pseudococcus*
   Auxiliary setae absent from cerarii other than anal-lobe pair ................. *Splanococcus*

28(20). Small discoidal pores absent from derm near hind coxae ................. 30
   Small discoidal pores present on derm near hind coxae ......................... 29

29(28). Anal lobe cerarius with more than 3 conical setae; without unusually long
   marginal setae on each of posterior 4 abdominal segments ................. *Palmiculcator*
   Anal lobe cerarius with 2 conical setae; with unusually long marginal
   setae on each of posterior 4 abdominal segments .......... *Saccharicoccus*

30(28). 6 or fewer pairs of cerarii ...................................................... 31
   More than 6 pairs of cerarii ....................................................... 30

31(30). Cerarii anterior of anal lobe pair without auxiliary setae ............... 33
   Cerarii anterior of anal lobe pair with auxiliary setae ......................... 32

32(31). Antennae 9-segmented; legs unusually long, extending beyond posterior apex of body .......... *Plotococcus*
   Antennae with fewer than 9 segments; legs not usually extending beyond posterior
   apex of body ......................... *Dysmicoccus*

33(31). Dorsal setae not conical, differently shaped than cerarian setae ...... 34
   Some dorsal setae conical, same shape as cerarian setae ....................... *Nipaecoccus*

34(33). Cerarii with 3 or fewer conical setae ........................................... 35
   Cerarii with more than 3 conical setae ....................................... *Paraputo*

35(34). With more than 10 pairs of cerarii; with an anal bar ...................... 36
   With fewer than 10 pairs of cerarii; without an anal bar ................. *Planococcus* (in part)

36(30). Dorsal tubular ducts absent or without associated setae, usually without
   sclerotization around orifice ....................................................... 37
   Dorsal tubular ducts with associated setae and sclerotization around rim .. *Ferrisia* (in part)

37(36). Multilocular pores present, at least near vulva ................................ 38
   Multilocular pores absent ........................................................... 37

38(37). Without or with 1 circulus ......................................................... 39
   With more than 1 circulus .......................................................... 38

39(38). Cerarii numbering more than 1 pair ........................................... 40
   Cerarii absent or restricted to anal lobe .................................... 41

40(39). On pines; body rotund ................................................................. 41
   On grasses; normally slender, elongate .......... *Oracella*

41(39). Not on grasses; body round or broadly oval ................................. 42
   Occurring on grasses; body often elongate or elongate oval .......... *Trionymus* (in part)
Checklist of Mealybugs of the Southern Region
(asterisk signifies a frequently collected species)

*Antonina nakaharai* Williams and Miller (misidentification of *A. crawii*) LA
*Antonina graminis* (Maskell) AL, FL, GA, LA, MS, PR, SC, TX
*Antonina pretiosa* Ferris FL, GA, LA
Antoninoides bouleoue (Parrott) TX
Antoninoides nortoni (Parrott and Cockerell) FL, GA, NC, TX
Antoninoides parrotti (Cockerell) FL, MS, TX
Brevennia rehi (Lindinger) FL, PR, TX
*Chaetococcus bambusae* (Maskell) FL, PR
*Chnaurococcus trifoli* (Forbes) VA
Chrizococcus dentatus (Lobdell) MS, VA
Chrizococcus graysoni Brachman and Kosztarab VA
Chrizococcus nakaharai Williams and Granara de Willink PR
Chrizococcus psoralae McKenzie TN
Chrizococcus rostellum (Lobdell) LA, MS, VA
Chrizococcus shaferi (Hollinger) MS
Crisicoccus taxodii Kosztarab FL, GA, VA
Distichlicoccus alkalinus (Cockerell) TX
Distichlicoccus digitariae Williams and Granara de Willink PR

Dysmicoccus bispinosus Beardsey PR
*Dysmicoccus bonisins* (Kuwana) FL, GA, LA, MS, PR
*Dysmicoccus brevipes* (Cockerell) FL, LA, PR
*Dysmicoccus difficilis* (Lobdell) MS, VA
*Dysmicoccus diodium* (McConnell) MS, SC, VA
*Dysmicoccus grassii* (Leonardi) PR
*Dysmicoccus juncuus* (McConnell) VA
*Dysmicoccus lassii* (Cockerell) FL, VA
*Dysmicoccus merrelli* (Ferris) FL
*Dysmicoccus milleri* Kosztarab AL, FL, GA, VA
*Dysmicoccus merrisiu* (Hollinger) AL, GA, LA, MS, VA
*Dysmicoccus neobrevipes* Beardsley FL, PR
*Dysmicoccus oabes* (Lobdell) AL, AR, GA, LA, MS, NC, SC, VA

*Dysmicoccus texensis* (Tinsley) TX
*Dysmicoccus vaccini* Miller and Polavarapu NC
*Dysmicoccus wistariae* (Green) VA
Euryccoccus blanchardii (King and Cockerell) MS, VA
Euryccoccus campbellii Kosztarab VA
Euryccoccus capillinae Ferris FL
Euryccoccus yeuceae Ferris TX
Ferrisia claviseta (Lobdell) MS
Ferrisia floridana (Ferris) FL
Ferrisia quiniancii (Tinsley) CA
Ferrisia virgata (Cockerell) FL, LA, PR, TX, VA
Geococcus coffeae Green FL, PR
Heliococcus desertica Miller TX
Heliococcus insignis (Lobdell) LA, MS
Heliococcus osborni (Sanders) LA, TX, VA
Heliococcus stachyos (Ehrhorn) VA
Heliococcus wheeleri (King) TX
Heterococcus nudus (Green) VA
Heterococcus rauzi Miller SC
Humococcus atriplicis Ferris TX
Humococcus dasyclaoe (Ferris) TX
Humococcus hilariae (Ferris) TX

Hypogeococcus barbarae Rau VA
Hypogeococcus hamoni Miller FL
Hypogeococcus margaretae Miller FL
Hypogeococcus spinosus Ferris TX
*Macelnichoccus hirsutus* (Green) FL, PR
*Mica.iconsoccus miscanthi* (Takahashi) VA
*Nipa.coccus nipae* (Maskell) FL, LA, PR
*Orachea acuta* (Lobdell) FL, GA, KY, LA, MS, NC, SC, TX, VA

Palmicoccus brouni Williams and Watson FL
*Palmicoccus palmarum* (Ehrhorn) FL
*Palmicoccus lumpyrensis* (Takahashi) FL
Paludicoccus distichium (Kuwana) TX
Paracoccus juniperi (Ehrhorn) TX
*Paracoccus marginatus* Williams and Granara de Willink FL
Paracoccus townsendi (Cockerell) TX
Paradoxococcus medanieli McKenzie AL, FL, GA, MS, SC, TX, VA
Paraputo olivaceus (Cockerell) (=Cataenoecoccus olivaceus) FL, TX
Peliococcus flaveolus (Cockerell) VA
Peliococcus serratus (Ferris) TN, VA
Phenacoccus acericola King KY, TN, VA
Phenacoccus acericolora King, KY, TN, VA
Phenacoccus colemani Ehrhorn FL, PR
Phenacoccus dearnessi King, TX, VA
Phenacoccus gossypii Townsend and Cockerell FL
Phenacoccus helianthii (Cockerell) TX
Phenacoccus horotaram Bachman and Kosztarab VA
Phenacoccus hardi McKenzie TX
*Phenacoccus madeirensis* Green AL, FL, LA, MS, NC, PR, TX, VA
Phenacoccus minimus Tinsley VA
Phenacoccus parvus Morrison FL, PR
Phenacoccus rubivorus Cockerell NC, VA
*Phenacoccus solani* Ferris FL, LA, PR, TX, VA
*Phenacoccus solenopsis* Tinsley FL, MS, TX, VA
*Planococcus citri* (Risso) AL, AR, FL, GA, KY, LA, MS, NC, PR
SC, TN, TX, VA

*Planococcus ficus* (Signoret) AL, FL, GA, NC, SC, TX
*Plutococcus crenatae* Miller and Denno FL
*Pseudantonina arundinariae* McConnell SC
*Pseudantonina giganticoxa* Lobdell FL, GA
*Pseudantonina nakaharai* Kosztarab VA
*Pseudantonina wilkeyi Kosztarab VA
Pseudococcus bryberia Ferris TX
Pseudococcus hryberia Gimpel and Miller FL, GA, VA
*Pseudococcus constricti* (Kuwana) GA, LA, SC, VA
Pseudococcus dasyliriae Gimpel and Miller TX
Pseudococcus dolichomelos Gimpel and Miller FL, NC, SC, TX
Pseudococcus donryei Gimpel and Miller TX
*Pseudococcus elisae* Borchsenius FL
Pseudococcus importatus McKenzie FL
*Pseudococcus jackbeatleyi* Gimpel and Miller FL, PR, TX
*Pseudococcus longispinus* (Targioni Tozzetti) AL, FL, NC, PR, TN, TX
*Pseudococcus maritimus* (Ehrhorn) AR, FL, GA, TN, TX, VA
Pseudococcus microcarulus McKenzie FL
Pseudococcus nakaharai Gimpel and Miller FL, TX

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Pseudococcus odermatti Gimpel and Miller FL
Pseudococcus pithecellobii Gimpel and Miller TX
Pseudococcus puertoricensis Gimpel and Miller PR
Pseudococcus sorgiiellus (Forbes) AR, FL, GA, LA, NC, SC, TN, VA
Pseudococcus spanocera Gimpel and Miller AR, FL, GA
*Pseudococcus viburni* (Signoret) AL, FL, GA, NC, SC, VA
Rhizoecus americanus (Hambleton) FL, PR
Rhizoecus apitzicus Hambleton TX
Rhizoecus caecicus (Hambleton) FL
Rhizoecus dianthi Green FL
Rhizoecus bicirculus McKenzie TX
Rhizoecus brevirostris Hambleton TX
Rhizoecus bituberculatus McKenzie NC
Rhizoecus distinctus (Hambleton) TN, VA
Rhizoecus falciifer Kunckel d’Herculaie FL
Rhizoecus floridanus Hambleton FL, GA
Rhizoecus gracilis McKenzie TX, VA
Rhizoecus hibisci Kuzawa and Takagi FL, PR
Rhizoecus kelloggi (Ehrhorn and Cockerell) FL, TX
Rhizoecus keyensis Hambleton FL
Rhizoecus laudiae Hambleton FL
Rhizoecus leucosomus (Cockerell) FL, TX, VA
Rhizoecus martimitus (Cockerell) FL
Rhizoecus mexicanus (Hambleton) FL, TX
Rhizoecus palestanicae (Hambleton) FL
Rhizoecus pseudoacticans Hambleton FL
Rhizoecus simplex (Hambleton) FL
Rhizoecus spicatus Hambleton FL
Rhizoecus solani (Hambleton) TX
Rhizoecus spinipes (Hambleton) AR, FL, GA
Saccharicoccus sacchari (Cockerell) PR
Spilococcus eriogoni (Ehrhorn) TX
Spilococcus gutierreziae (Cockerell) TX
Spilococcus prosopidis (Cockerell) TX
Spilococcus steelli (Cockerell and Townsend) TX
Stemmatomerinx acircula Howell and Miller FL
Stemmatomerinx adenticulata Howell and Miller GA
Stemmatomerinx aristida Howell and Miller GA
Stemmatomerinx beshearea Howell and Miller GA
Stemmatomerinx decorata Ferris TX
Syrnococcus spirapuncta (Lobdell) FL, MS
Syrnococcus pecosensis Ferris TX
Tridiscus matilaeos Kosztarab SC
Trionymus americanus (Cockerell) MS
Trionymus carciis McConnell FL, GA, SC, TN, VA
Trionymus clandestiniasd McConnell VA
Trionymus louryii Brachman and Kosztarab VA
Trionymus mori Lobdell MS
Trionymus radicicola (Morrison) PR
Trionymus smithii (Essig) VA

Giant Mealybugs (Putoidea) of the Southern Region (asterisk signifies a frequently collected species)

*Puto Barberi* (Cockerell) PR
*Puto kosztarabi* Miller and Miller VA
*Puto lasiourum* (Cockerell) TX
*Puto mexicanus* (Cockerell) TX
*Puto yuccae* (Coquillett) TX

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