

## Guide to the Identification of Common Adult Male Mealybugs

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In scale insects, including the mealybugs, the nymphs and adult females are similar in appearance, and the adults are generally considered to have highly modified and reduced morphology. Nymphal and adult female scale insects may or may not have functional legs. However, the adult males are very different in shape and form from the immatures, having three distinct body divisions typical of most other insects, three pairs of fully functional legs, and usually have one pair of flight wings. The males of most mealybugs are very tiny, and are only about a third of the size of the adult females of the same species.

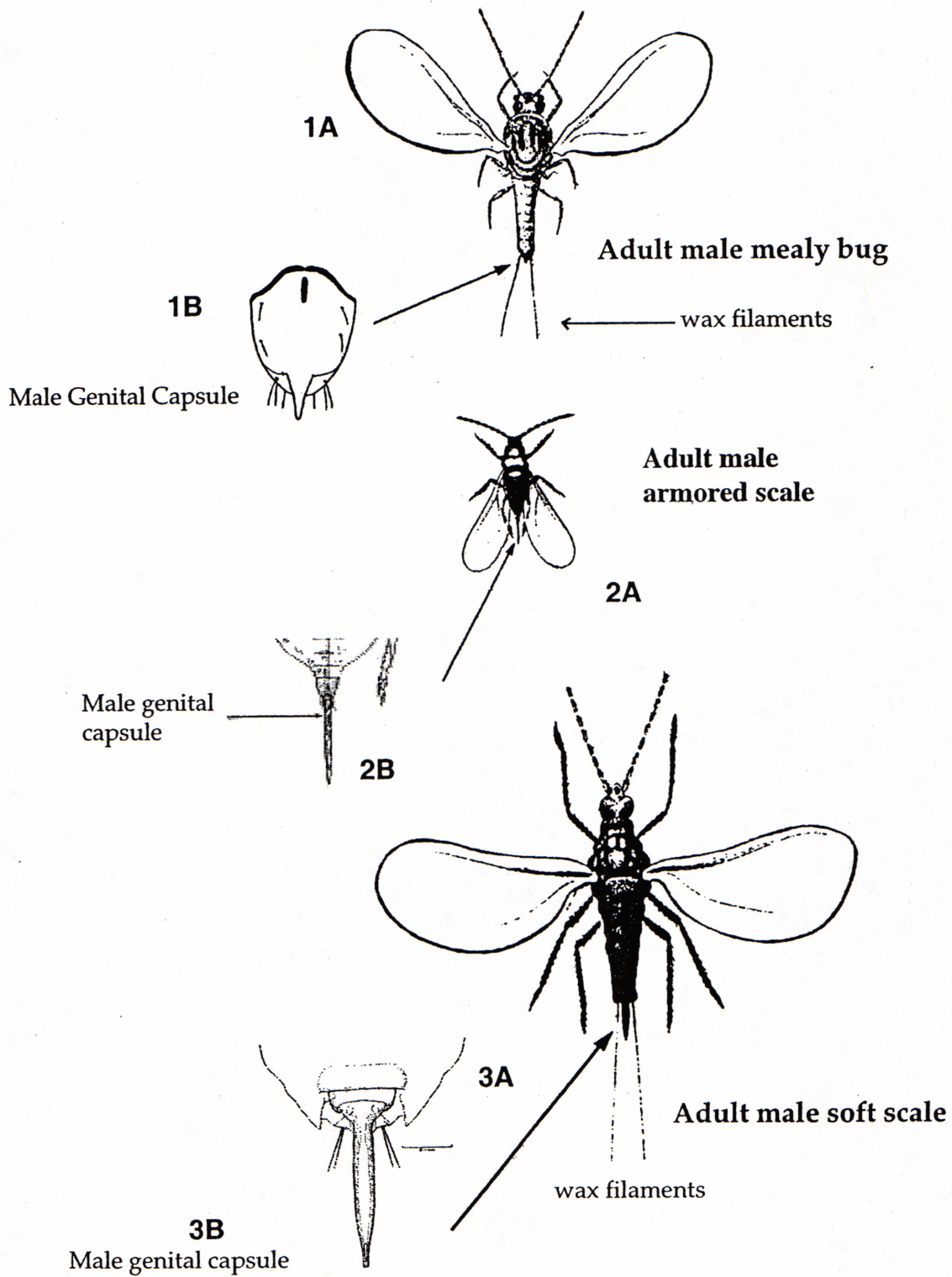
In many species of scale insects, it has been shown that the females produce a pheromone scent that allows the males to locate the females. It has also been shown that the males can be lured into sticky traps that are baited with the specific pheromones that attract mostly only the target species. It has been shown also that a white trap card is most effective in attracting the males. However, the white coloration of the sticky trap card will not be species specific, and the cards will attract the males of other scale insects, especially mealybug males. In California a program to detect infestation of the vine mealybug using male pheromone traps is currently in operation. This program is using enclosed tent traps, which greatly reduces the number of males of non-target species found in the traps.

This key has been designed to provide a dependable way to diagnose for the presence of the target adult male scale insects found in the cards or traps, and to exclude from concern those that are not target species. There are three major groups or families of scale insects, the soft scales or Coccidae, the armored scales or Diaspididae, and the Pseudococcidae or the mealybugs. There are about a dozen other families of scales, but they are rather rare compared with mealybugs and probably will not be encountered with this trapping method very often.

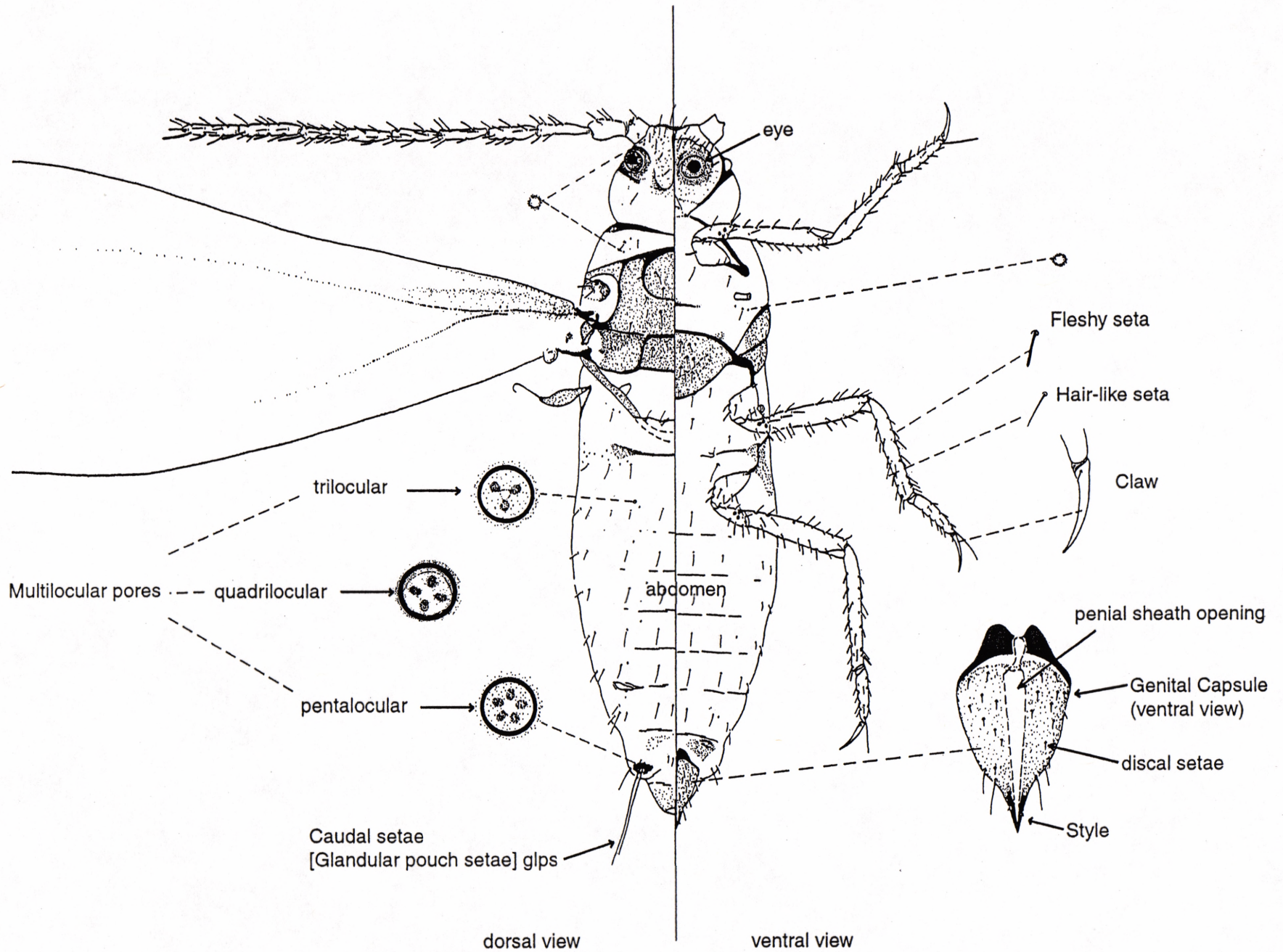
The males of other common scale families, armored and soft scales, can be quickly recognized with a dissecting microscope or a hand lens by the shapes of the tips (male structures or genital capsules) of the abdomens (see Figures 2 & 3). The male structures in these families are elongated, and in the armored scales, almost as long as the rest of the abdomen. The terminal structures of the males of mealybugs are shortened and triangular in shape, rather than elongate (see Figure 1).

Once it is determined that the specimen on the card is a male mealybug, then it will be necessary to carefully remove the specimen from the card and clear it of the sticky trap material (see included procedures for doing this step). The specimen then should be cleared and mounted UPSIDE down (legs up) on a microscope slide (see included procedures for doing this step). The structures to be studied may include the antennal structures in some cases, but primarily the shape and setation (location of setae or hairs) on the underside of the male genital capsule (see illustrations for each individual species listed etc.).

Once it is determined which species are commonly encountered on the traps in a given area, it may be possible to determine species solely by recognition of characters that can be seen with a dissecting microscope, rather than going through the slide mounting process. Until that time, however, it will be necessary to use the slide-mount technique to validate the trap catches.



Comparison of male mealybugs with males of other common scale insects which may be found in mealybug pheromone traps.



**General Anatomy of an Adult Male Mealybug**

(Illustration adapted from Miller and Denno, 1977: Syst. Entomol. 2:111-157)

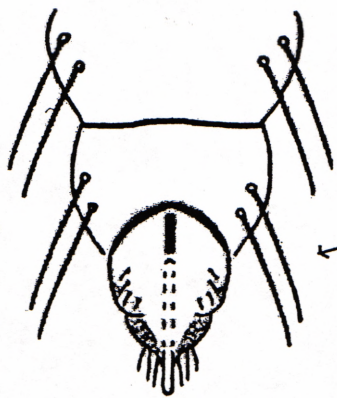
## Key to male mealybugs likely to be encountered in pheromone traps in California and the Caribbean Regions

(This key is designed for use with slide mounted specimens only)  
(General terminology and abdominal segment enumeration based on Afifi 1968)

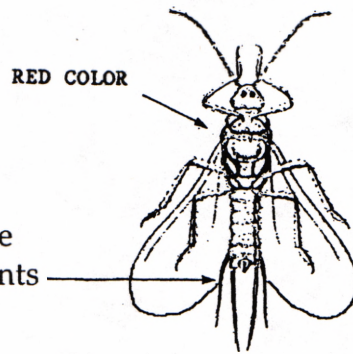
1. Abdomen with two pairs of glandular pouch (gp & glp) pore groups and accompanying tail setae (gls-ts & glps), these present on abdominal segments 7 & 8; often reddish in color compared to brown or tan in other genera (very few males known in this group, most common is *Phenacoccus madeirensis*) ..... *Phenacoccus* group
- Abdomen with only one pair of glandular pouch pore groups and setae, these present on abdominal segment 8 ..... 2
  
2. With a sclerotized, loop-like structure which supports the base of the aedeagus and projects anteriorly beyond the genital capsule. (pink hibiscus mealybug) ..... *Maconellicoccus hirsutus*
- Genital capsule normal, without anteriorly or forward projecting extensions ..... 3
  
3. Short fleshy or digitiform setae numerous on most antennal segments, much shorter and broader than hair-like setae (most common is *Chorizococcus rostellum*, Bermuda grass mealybug and *Spilococcus mammillariae*, cactus mealybug). ..... *Chorizococcus/ Spilococcus* group
- Fleshy setae on antennae not short, usually about the same length as the hair-like setae ..... 4
  
4. Setae on entire antennal segments 3 and 4 predominately or exclusively of the long, fleshy type, nearly as long as antennal segments 4 to 8 (striped mealybug). ..... *Ferrisia virgata* & *Ferrisia malvastrum*
- Both fleshy and hair-like setae present on all antennal segments, often in nearly equal numbers ..... 5
  
5. Median edges of penial sheath opening on venter of genital capsule expanded laterally or posteriorly into broad, quadrangular lobes, finger-like lobes or other processes, usually with associated penial sheath process setae (pros) ..... 6
- Median edges of penial sheath opening on venter of genital capsule only slightly expanded (wart-like) or not at all ..... 9
  
6. Long fleshy setae present on thorax and abdomen along with hair-like setae; penial sheath process long, expanded posteriorly; style (st) of genital capsule broad, apically truncated. (longtailed mealybug). ..... *Pseudococcus longispinus*
- Only hair-like setae present on abdomen and thorax; penial sheath process short, directed laterally (medially); style narrow, finger-like, apically rounded or acute . . 7
  
7. Penial sheath process setae (pros) situated on large, inwardly directed lobes; penial sheath opening widened posteriorly: aedeagus very thin and narrow throughout in both lateral and dorsal/ventral views, with a blunt apex; antennal fleshy setae nearly as long as hair-like setae and longer than the width of the antennal segment they occupy (vine mealybug, citrus mealybug). . *Planococcus ficus*, *Planococcus citri*

(and possibly *Nipaecoccus nipae*, coconut mealybug, based on interpretation of some specimens)

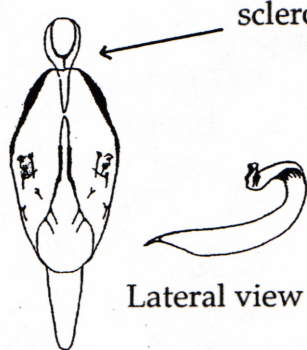
- Penial sheath process setae (pros) not situated on an enlarged, inwardly directed lobe but may appear so in some specimens; if so then antennal fleshy setae 1/2 the length of the hair-like setae and shorter than the width of the antennal segment they occupy; aedeagus thick at base, broad in both lateral and dorsal/ventral views, gradually tapering to an acute apex. . . . . *Paracoccus marginatus*
  
- 8. Penial sheath process setae (pros) situated on a shallow wart-like protruberance, usually somewhat lobate posteriorly, many genera including at least: . . . . .  
. . . . . *Paracoccus, Chorizococcus, Spilococcus, Nipaecoccus, Vryburgia*
- Penial sheath process setae (pros) apparently not situated on a wart-like protuberance. . . . . 9
  
- 9 Penial sheath process setae (pros) and ventral discal setae distinctly present. . . . . 10
- Penial sheath process setae (pros) absent but ventral areas of genital capsule usually with multiple pairs of discal setae (includes *Ferrisia*) . . . . . 13
  
- 10. Tip of aedeages forked (bifid) with blunt sclerotized tines (apices); fleshy setae thick and lanceolate, prevalent on the dorsal and ventral central areas of the abdomen (5 or more dorsal pairs) . . . . . *Dysmicoccus mackenzi*
- Tip of aedeagus forked or not, if so then tines (apices) sharply acute apically. . . . . 11
  
- 11. Tip of aedeages forked (bifid) but with sharply acute tines (apices), the connective between the apices membranous; fleshy setae thick and lanceolate, prevalent on the dorsal and ventral central areas of the abdomen (5 or more dorsal pairs); penial sheath process setae (pros) numbering 4 or 5 pairs, aligned in a widely spaced row on either side of penial sheath opening (grape mealybug, obscure mealybug) . . . . .  
. . . . . *Pseudococcus maritimus/viburni* group, some *Dysmicoccus* species
- Tip of aedeages not forked; central abdominal fleshy setae, if present, thin, not much thicker or longer than hair like setae; with 2 pairs of quadrilocular pores on vertex of head . . . . . 12
  
- 12. Dorsal/ventral abdominal fleshy setae present, short, thin, not longer than 1/2 the width of the segment they occupy. . . . . *Dysmicoccus boninsis*
- Dorsal/ventral abdominal fleshy setae apparently absent, or if present not distinguishable from the hair-like setae; abdominal hair-like setae long, as long or longer than the width of the segment they occupy (citrophilus mealybug). . . . .  
. . . . . *Pseudococcus calceolariae*
  
- 13. Fleshy setae on antennal segments 3 to 8 restricted to distal (far) ends of the segments . . . . . *Brevennia rehi*
- Antennae not as above. . . . . 14
  
- 14. Genital capsule in dorsal/ventral view triangular (equilateral) (Comstock mealybug)  
. . . . . *Pseudococcus comstocki, Pseudococcus odermatti*
- Genital capsule in dorsal/ventral view elongate triangular, boat shaped. . . . .  
. . . . . *Pseudococcus cryptus*



*Phenacoccus* sp.



2 pairs of candal setae  
2 pairs of wax filaments

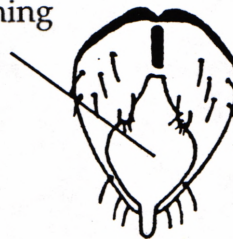


*Maconellicoccus hirsutus*  
pink hibiscus mealybug

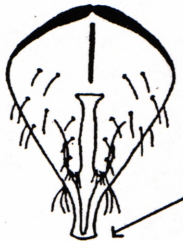
sclerotized loop

Lateral view of aedeagus

penial sheath opening



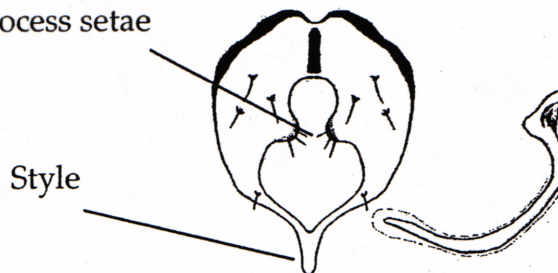
*Chorizococcus rostellum*  
Bermuda grass mealybug



*Pseudococcus longispinus*  
longtailed mealybug

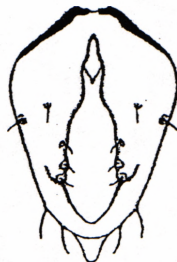
style

P.S. process setae  
(pros)



*Planococcus citri*  
citrus mealybug

Lateral view  
of aedeagus

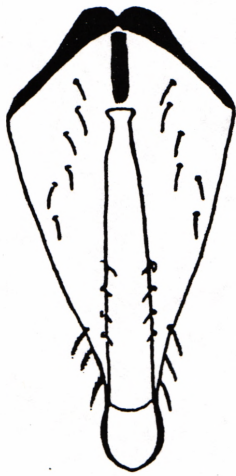


*Paracoccus marginatus*  
papaya mealybug

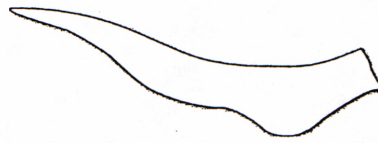


Lateral view of aedeagus  
and genital capsule of  
*Planococcus citri*

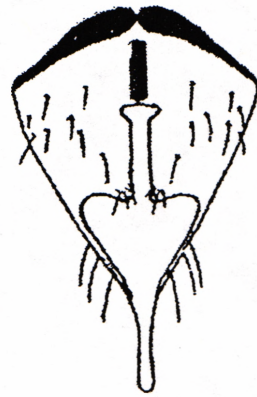
General Anatomy of Male Mealybug Genital Capsules (1)



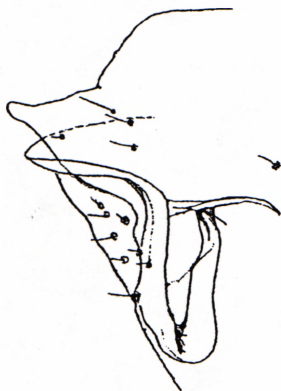
*Pseudococcus viburni*  
*Pseudococcus maritimus*  
 obscure & grape mealybug



aedeagus  
 lateral view



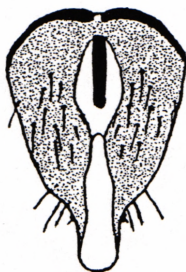
*Saccharicoccus sacchari*  
 pink sugarcane mealybug



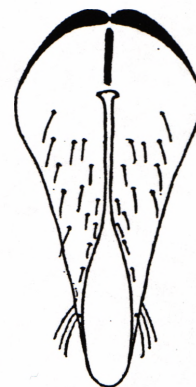
*Ferrisia virgata*  
 Lateral View



*Ferrisia virgata*  
 striped mealybug

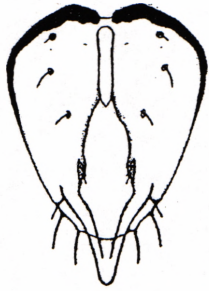


Comstock mealybug  
*Pseudococcus comstocki*

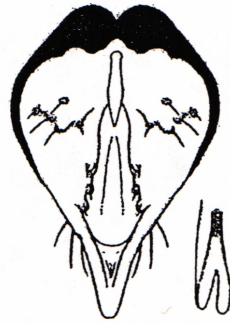


*Pseudococcus cryptus*  
 citriculus mealybug

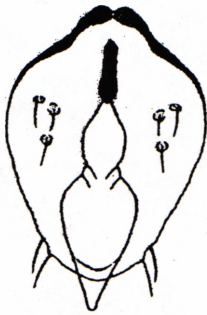
General Anatomy of Male Mealybug Genital Capsules (2)



*Dysmicoccus boninsis*  
gray sugarcane mealybug



*Dysmicoccus mackenziei*  
McKenzie mealybug



*Nipaecoccus nipae*  
coconut mealybug



*Phenacoccus madeiriensis*  
or *Phenacoccus gossypii* or  
both??  
Mexican mealybug

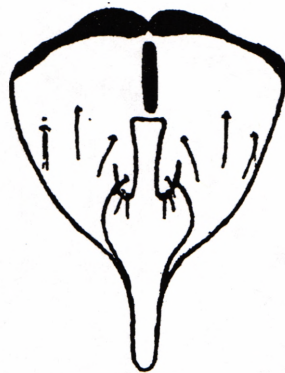


*Nipaecoccus nipae*  
coconut mealybug

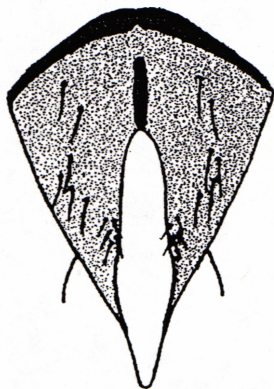
\*Alternate illustration\*



*Dysmicoccus neobrevipes*  
pineapple mealybug



*Vryburgia amaryllidis*  
lily bulb mealybug



*Pseudococcus calceolariae*  
Citrophilus mealybug