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# Classical Biological Control of Weeds with Insects: Melaleuca Weevil[1]

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Melaleuca, *Melaleuca quinquenervia* (Cav.) S.T. Blake (Myrtaceae), is an invasive woody plant that is native to Australia, New Guinea, and the Soloman Islands. Melaleuca, also known as the paper bark tree, cajeput, punk tree, or white bottlebrush tree, was introduced into Florida in the late 19th century but apparently failed to naturalize until 1906. It was planted extensively as an ornamental, and eventually invaded suitable forested and non-forested wetland habitats in south Florida forming dense monocultures (Figure 1). Melaleuca currently infests over 200,000 ha of wetland ecosystems in this region, most notably the sawgrass marshes that comprise the Florida Everglades, and annually causes about $168 million in environmental losses. Chemical, mechanical and cultural control practices have been used to manage melaleuca in south Florida. However, these methods can be expensive, are ecologically disruptive, and provide only temporary control of this highly invasive plant.

Melaleuca is not considered a weed in Australia because a complex of natural enemies that do not occur in Florida attacks it in its native range. Classical biological control, in this case the introduction of host specific natural enemies into Florida from Australia, is being investigated as a possible long-term solution to the melaleuca problem. Five insects have been imported into quarantine for host specificity testing by USDA scientists. One of these insects is the melaleuca snout beetle or weevil *Oxyops vitiosa* (Pascoe) (Insecta: Coleoptera: Curculionidae) (Figure 2).

## Description

**Adult.** Melaleuca weevils are small, gray and 6 to 9 mm in length. Males are usually smaller than females. The adults are somewhat cryptic in appearance, but are usually found on the leaves and stems of saplings (Figure 3), or the new growth of older trees where they feed, mate and deposit their eggs. The presence of adults is usually indicated by the characteristic feeding damage that consists of holes or gouges chewed into the buds, leaves and stems. Occasionally, young shoot tips are nearly excised when stem feeding occurs on the tender new growth (Figure 4).

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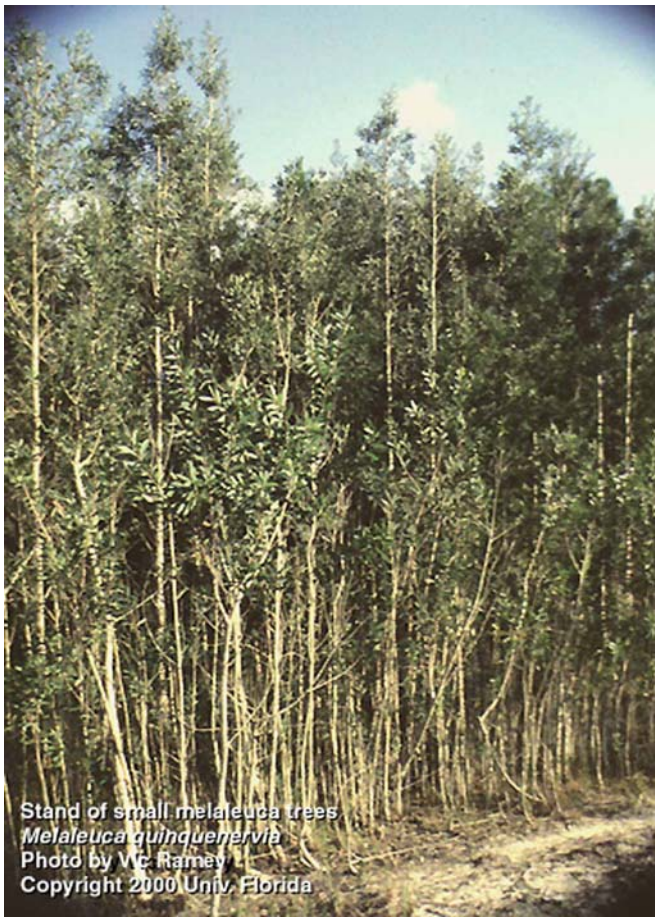


**Figure 1.** Stand of young melaleuca trees in south Florida.


**Figure 2.** Melaleuca weevil *Oxyops vitiosa* (Pascoe) adult on melaleuca leaf.

**Egg.** The eggs of the melaleuca weevil are yellow, 1 mm long and resemble gel capsules (Figure 5). The female almost always covers the eggs in a secretion as soon as they are deposited to protect them from desiccation or predation. This secretion dries to form a hard protective casing, which is brown to black in color. When the eggs are present, they are usually associated with adult feeding damage.


**Figure 3.** Two melaleuca weevil adults feeding on melaleuca leaves.

**Figure 4.** Excised shoot tip of melaleuca caused by adult weevil feeding damage.

**Larva.** The larval stage has four instars, or growth phases. The appearance and size of the larvae vary depending upon their age. Neonates, or newly hatched larvae, are yellow and less than 1 mm long. In contrast, the mature larvae are 14 mm in length, grayish in color, and are slug-like in appearance. Developing larvae are usually covered with translucent yellow or orange oily secretion that turns black after fecal material is incorporated into it. This oily secretion mixed with fecal matter affords the larvae protection from fire ants and possibly other predators. This fecal matter is produced as a long thin coil (Figures 6 and 7).

The feeding damage produced by the larval stage is very different from the adults. Instead of chewing

**Figure 5.** Eggs of melaleuca weevil on young leaves; uncovered (yellow) and covered with a brown to black secretion.

holes in the leaves, the larvae consume all layers of the leaf except for the cuticle on the opposite side. The appearance of the paper-thin feeding trails in the leaves produced by the developing larvae is a clear indication that melaleuca weevils are present (Figure 7). Prior to pupation, the mature larvae, or prepupae, cease feeding and are yellow in color.


**Figure 6.** Larva of melaleuca weevil feeding on melaleuca leaf. Note fecal coil attached to larva.

**Figure 7.** Melaleuca leaf showing feeding damage and larvae of the melaleuca weevil.

**Pupa.** The pupal stage is not visible because it occurs beneath the soil surface. Larvae develop to the pupal stage inside an earthen capsule formed by the prepupae. The pupal capsule, which is made of soil and an oily secretion produced by the insect, is approximately 10 mm in diameter. The newly formed pupae are of the exarate type (i.e. the legs and wings are free and not glued to the body), and are yellowish in color but turn brown prior to emergence of the adults from the soil.

## Distribution and Life Cycle

The melaleuca weevil is native to Australia. This insect was released in Florida in 1997 after Australian field studies and laboratory testing demonstrated the weevil would reproduce only on melaleuca. Establishment of the weevil has been confirmed in these 7 south Florida counties, Broward, Collier, Dade, Glades, Lee, Palm Beach and St. Lucie.

Adults feed and reproduce on the leaves and shoots of saplings as well as the new growth of mature melaleuca trees. Females begin to produce eggs when they are approximately 6 weeks old and can live up to 10 months. They will deposit up to 9 eggs per day and produce from 500 to 1000 eggs during their lives. The egg stage lasts approximately 7 days, and larvae begin to feed immediately upon hatching. Larvae will complete their development in approximately 7 weeks and migrate down the stems

as they mature. When the larvae become prepupae (cease feeding), they crawl or drop to the ground to complete their development to the adult stage. The larvae will select a suitable site underground to form a pupal capsule from the surrounding soil. The insects will remain in the pupal stage for approximately 2 to 6 weeks but usually 4 weeks. Based on laboratory studies, development from the egg to the adult stage occurs in approximately 12 weeks. In south Florida, new adults appeared in the field 3 months after the weevil was initially released, which suggests the melaleuca weevil is able to produce two to three generations per year in Florida's subtropical climate.

As mentioned previously, part of the life cycle of the melaleuca weevil occurs in the soil. While soil type does not appear to preclude establishment, pupation success may be higher at sites with sandy soils. Field and laboratory studies indicate the larvae can pupate under soil conditions ranging from saturated to drier areas with a high relative humidity. However, habitats in south Florida that are characterized by infrequent flooding, moderate melaleuca densities, and dry winters favor weevil establishment. Failure of the weevil to establish at permanently flooded sites suggests these conditions are not conducive to normal pupation, probably because submersed pupae cannot survive without oxygen for any length of time.

Larvae are commonly observed on melaleuca plants in south Florida from October to May, which coincides with flushes of new leaf growth. Adults are present only during the summer months unless the melaleuca is mowed or otherwise damaged. Any activity that stimulates new leaf growth (e.g., shoot regrowth from cut stumps, damaged branches, root suckering, etc.) will support larval populations year-round at a specific site.

## Importance

Both adults and larvae damage melaleuca by disrupting the plants' normal growth processes. Large larvae can destroy most of the leaves on several shoots of an individual plant. At several sites in south Florida where high populations of the larvae have been observed, extensive areas of damaged melaleuca foliage are evident. Reduced flowering (up to 90%) also has been demonstrated experimentally by USDA/ARS scientists at several sites in south Florida where the weevil is established. This type of feeding damage may help to reduce seed production and prevent further spread of this highly invasive plant.

Because the insect disperses slowly, a coordinated redistribution program was used to establish the insect in all 22 counties in central and south Florida which are infested with melaleuca. A standardized procedure for collecting and transporting the adult melaleuca weevils to other sites where the weevil is not yet established was first developed and implemented in St. Lucie County (Figure 8).

**Figure 8.** Procedure for collecting adult melaleuca weevils for redistribution (photograph by K. Gioeli).

The melaleuca weevil is one of the key components of The Areawide Management and Evaluation of Melaleuca, or T.A.M.E. Melaleuca. This pest management program, which was initiated in 2001, was designed to promote long-term, biologically-based melaleuca management through partnerships with public agencies and private land

managers. The goal of T.A.M.E. melaleuca is to demonstrate the effectiveness of an IPM approval for controlling meleuca in the United States and beyond.

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