Eucalyptus snout beetle

Snout beetle larvae feeding on eucalyptus leaf

Biological Control of the Eucalyptus Snout Beetle, *Gonipteras scutellatus*

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In the past few years, insect species native to Australia have been accidentally introduced into California, including the eucalyptus longhorned borer and the blue-gum psyllid. The most recently introduced pest is the eucalyptus snout beetle (ESB), *Gonipterus scutellatus* Gyll., which was first detected in March 1994 in Ventura County, California. ESB has a long history as a severe pest of eucalyptus wherever it has been introduced, including South and Central Africa, the Mediterranean basin, New Zealand, and South America. The adults and larvae can rapidly strip a *Eucalyptus* tree of its leaves, buds, and shoots. In Ventura County, weevil populations had completely defoliated entire sections of some *Eucalyptus* windrows in a single season. Dense populations of weevils in many areas of the county in fall 1994 indicated that the devastation would greatly expand during the coming year. This apparently rapid population growth, and rapid spread of the weevil, is due in part to the abundance of blue gum, *Eucalyptus globulus*, and ribbon gum, *E. viminalis*, in the area. These *Eucalyptus* species are favored by the weevil, and the larvae and adults thrive on its foliage. Rapid growth of weevil populations is further favored by the mild climate of Southern California, which is an ideal environment for weevil development.

Fortunately, there is a very selective and effective biological control agent for the weevil. The mymarid egg parasitoid, *Anaphes nitens* Siscaro, also native to Australia, has been introduced into and established in nearly every country where the weevil has appeared. Our goal for this project is to introduce and establish *A. nitens* in California as an effective, permanent natural enemy of the pest G. *scutellatus*, and to minimize the damage caused by the weevil as its populations expand.

Accomplishments for 1995/96

Objective 1: Distribution and abundance of ESB in Southern California. The distribution of ESB was determined by estimating beetle density and assessing beetle-caused damage to foliage at 45 sites throughout the Ventura area. Sampling trees at measured distances (as discussed in the original grant proposal) proved impractical because *Eucalyptus* trees are not evenly distributed in Ventura County. Instead, stands of *Eucalyptus* were selected for sampling to maximize the sampling area. Moreover, care was taken to include stands at distances great enough to locate the edges of the beetle's range within the county.

Densities of beetles (including egg capsules, larvae and adults) were estimated by counting the numbers occurring on the terminal 20 cm of 20 branches on at least 10 trees at each site between 13 and 29 June, 1995. Sampling this part of the tree is an effective way of appraising beetle density because all life stages are confined to the younger foliage. Mean percent defoliation was calculated by examining the terminal leaves of the same 20 branches and estimating the percent eaten by beetles. Using this youngest foliage is the most sensitive method of appraising beetle activity since all

Parasitoid wasp *Anaphes nitens* on snout beetle egg case

sizes of larvae and the adults feed on these leaves, while only adults feed on older leaves. At sites where no leaf damage was detected in sampling, a visual survey using binoculars was made to determine whether the beetle was present.

Figure 1 is a map of the Ventura County area with highways, freeways and sample sites indicated. Some large areas are without sample points because of an absence of *Eucalyptus* trees. The greatest beetle damage was confined to an area near the center of the figure between highway 118 and the 101. Defoliation due to beetles dropped off sharply within about eight miles of this center point and beyond about ten miles no beetles were observed. All of the 45 sites were sampled again three months later on 26 - 28 September, 1995. By that time, beetle damage at most sites had generally declined due to a seasonal reduction in activity. However, beetles were found at three sites that had been uninfested (or at much lower densities) in June, indicating that beetle populations were still spreading. This spread is inevitable since the preferred host species, *Eucalyptus globulus* and *E. viminalis* are widely distributed throughout the area and further to the north and south along the coast.

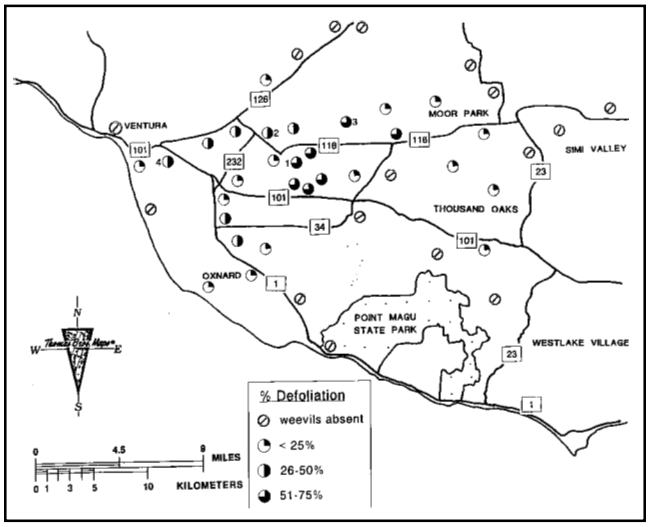
Since that survey ESB has lived up to its reputation as a rapid disperser. Our recent surveys have found it south of Pt. Mugu State Park from the Zuma Beach area to Topanga Canyon, and north to Lookout Park in Summerland just outside of Santa Barbara. We expect it to move through Santa Barbara county to the north and Los Angeles County to the south during the coming summer.

Objectives 2 and 3: Release of the egg parasitoid *A. nitens* and monitoring its establishment and spread. Parasitoids were first released at a single site in August and October, 1994. This site (Point 1 in Figure 1) was where ESB was first discovered. Only 300 parasitoids were released at the site. During 1995, we released 7,870 parasitoids at three other sites in Ventura County (Points 2 - 4 in Figure 1). The release strategy was to establish the egg parasitoids where beetle densities were high to ensure that parasitoids would find hosts. We confirmed that the parasitoids established at two of these sites, but too few eggs could be found in late summer to verify establishment at the third site. The lack of eggs in itself strongly suggested that the parasitoid had established and proliferated. In addition to our releases, the parasitoid spread on its own to three sites that were adjacent to the original release site (Point 1 in Figure 1).

Objective 4: Effectiveness of *A. nitens* in controlling populations of ESB and reducing damage. The impact of *A. nitens* on ESB activity was examined using monthly estimates of beetle abundance and levels of damage at six sites, including the four sites where parasitoids were released and two control sites which the parasitoid colonized on its own. Parasitism rate was measured by collecting 50 ESB egg cases per date and site, and placing them in individual gelatin capsules, then determining the percentage that yielded beetle larvae versus adult parasitoids. Beetle abundance was measured by counting egg cases, larvae, and adults on the terminal 20 cm of 20 branches on at least 10 trees. Percent defoliation of trees was estimated as described under Objective 1.

Representative data for the site where *A. nitens* was first released are presented here (Point l in Figure 1). Although only 300 parasitoids had been released at this site in fall 1994, parasitoids emerged from nearly 100% of ESB eggs collected in June, 1995 (Figure 2A). This finding suggests that the parasitoids had remained active through the winter, continuing to parasitize hosts and build their populations. Parasitism rates remained high through summer, 1995. As a result of this parasitism of ESB eggs, beetle larvae virtually disappeared at this site and have remained very scarce (Figure 2B). With so few larvae completing development, the beetle population gradually declined and by September, 1995 very few adult beetles or eggs could be found. With this sharp reduction in beetle abundance, levels of defoliation soon declined as trees produced new foliage that remained undamaged by beetle feeding (Figure 2C). By the end of 1995, trees at this site were recovering and now show little evidence of beetle activity. Results of other release sites have been similar, with weevil populations falling to insignificant levels within a year of release, and defoliated trees recovering.

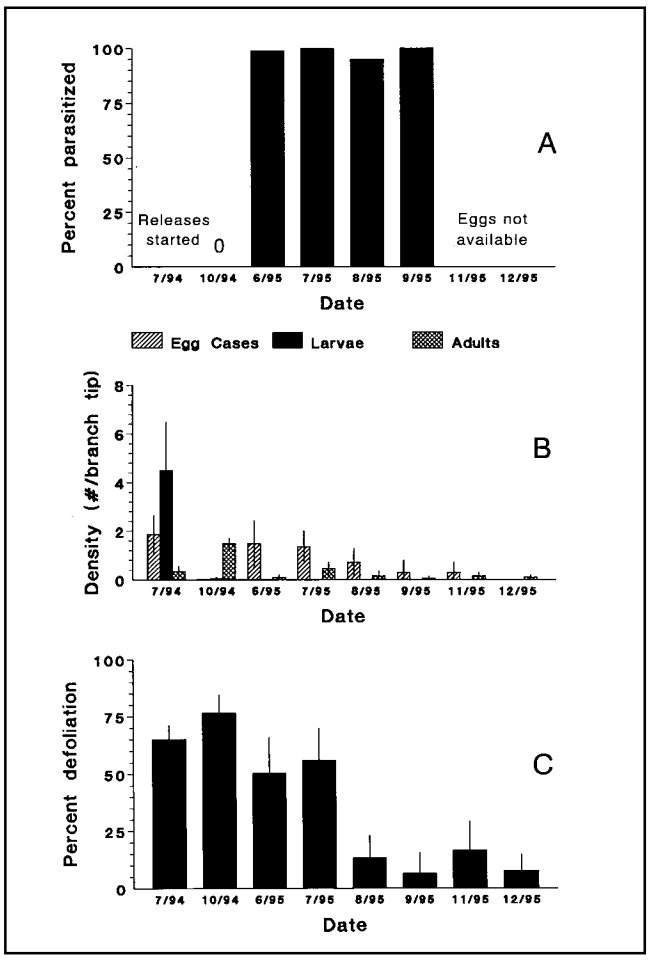
The egg parasitoid *A. nitens* is proving to be a



Above, damage levels of leaves at the study site in Ventura County. (Fig. 1)

highly effective biological control agent of ESB, inflicting very high rates of parasitism with the result that beetle densities decline to insignificant levels within a few months. However, the beetle continues to extend its range, and it is critical that releases of the parasitoid at new sites be continued as new isolated infestations are detected to minimize damage to *Eucalyptus* trees statewide. Because ESB adults are strong fliers, there is a good chance that new infestations are already developing in isolated localities and have yet to be detected. The adult beetles are known to disperse long distances and are easily transported because they drop from branches when disturbed and cling to whatever they land on, such as vehicles passing under infested trees. This opportunity for long distance movement is improved by the presence of infested trees along heavily traveled roadways (see Figure 1).

By colonizing distant areas, ESB may escape the egg parasitoid and populations may rapidly reach damaging levels. Locating these populations will depend on the assistance of UC Cooperative Extension personnel, farm advisors, and municipal, county and state officials (e.g., local and state park officers, Calif. Dept. of Forestry personnel) who have offered assistance in locating new beetle infestations. We have sent out a press release recently targeting newspapers in Santa Barbara, Ventura, and Los Angeles Counties to disseminate information on this pest to the public. Greater public awareness of the pest will allow us to better track its spread, so that we can conduct spot releases of the parasitoid to establish controls in isolated infestations before damage becomes severe. We have also prepared



Parasitization, density and defoliation from time of release of *A. nitens* through December, 1995. (Fig. 2)

and mailed out an information package to county agricultural commissioners in the counties where ESB is likely to appear.

In summary, we have imported and successfully established a very effective parasitoid of ESB at a number of sites. Data indicate that the parasitoid is able to effectively suppress ESB densities to insignificant levels. By implementing this biological control strategy through continued parasitoid releases as new ESB infestations arise, we can minimize the economic impact of this severe pest on California landscapes.

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