1994 Turf Insect Monitoring Study

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Summary:

An insect monitoring study was initiated to provide the basis for a turf insect integrated pest management (IPM) program. Weekly black light trap counts of adult insect pests of turf were collected from ten Southern California golf courses from March 7 through October 12, 1994. Key results from the study's first year include:

- **Black turfgrass ataenius** (BTA) was the most damaging and most difficult to control insect detected, particularly on cool season turf (bentgrass, rye, bluegrass and mixtures). Damage caused by BTA was a combination of direct feeding by grubs, and damage caused by birds searching for grubs. At least 3 generations of BTA were observed from late June to early October. This is in contrast to the 1 - 2 generations recorded for BTA in the Eastern U.S., where it has been most widely studied.
- **Black cutworms and common armyworms** were an almost constant presence at all courses from April through September. Larvae (caterpillars or worms) of these insects caused some damage at several courses, but populations were easily controlled through insecticide applications. Damage caused by these pests was a combination of direct feeding by insect larvae, and damage caused by birds searching for larvae.
- **Bird damage** was observed at all courses on greens and tees, especially in late July and early August. However, cutworm and armyworm larvae were sometimes difficult to find despite the bird damage. One possible explanation is that birds were searching for BTA grubs which were prevalent during this time period, rather than for cutworms and armyworms. Because BTA grubs are

rarely seen on turf (they are very small and feed in the thatch/soil interface), the damage they cause may erroneously be attributed to cutworms

- The population models currently available for prediction of BTA and black cutworm development were designed for temperate climates where average air temperatures frequently dip below 32°F . For this reason these models were not applicable for Southern California where average air temperatures are rarely below 50°F.
- Attempts to monitor armyworm and cutworm larval populations via the soil drench method did not provide useful information for the purposes of timing insecticide applications. Black light trap counts of adults and monitoring for insect and/or bird damage were more reliable indicators of the presence of these pests.
- Other pest insects including sod webworms, variegated cutworms, masked chafers and May/June beetles were detected at all participating courses, but caused no significant damage to turf in 1994.

Recommendations:

- A second year of monitoring should be performed in 1995 to allow development of population models for armyworms, cutworms and BTA that can be utilized under Southern California climactic conditions to predict the timing of populations. The study should be conducted from 4/11/95 - 10/17/95.
- Until insect population models are developed, monitoring adults via black light traps will provide the most useful means of effectively timing insecticide applications.
- For most effective control of BTA, 1st generation adults or larvae should be targeted in June and July. If the first generation is effectively controlled, damage from the second generation (which can be larger and more devastating than the first generation) can be reduced.
- Because the damaging BTA is very similar in appearance to the non-damaging *Aphodius* beetle and the beneficial ground beetle, superintendents should confirm the identity of the insect as BTA before insecticides are applied.
- Damage from insects was most significant in the period **July 25 - August 8, 1994**. This was apparently due to two factors: 1) high insect populations (both worm larvae and BTA larvae were present during this period) and 2) stressed turf due to hot weather (the highest temperatures of the year occur during this period: see air temperature graphs for weeks 29 - 32 in Appendix A: Weather Summary). In 1995, attempts will be made to use black light trap data to time insecticide applications PRIOR to this period to avoid insect damage before it occurs.
- Because armyworms and cutworms are present almost constantly throughout the year, timing insecticide applications can be problematic. Since many effective

insecticide treatments are available for worm control, superintendents are advised to delay treatments until signs of significant damage (from worms and/or from birds) are observed.

Background:

Southern California golf course superintendents have long expressed their interest in implementing integrated pest management programs (IPM) for insect pests, but insufficient information existed on the types of insects present, their life cycles, the timing of their occurrence, and the level of damage they caused. To address this information gap, an insect monitoring study based on weekly black light trap catches of key turf insect pests was initiated in March, 1994. The goal of the study was to utilize insect trap counts collected to:

1. determine timing and occurrence of key turf insect pests including cutworms, armyworms and BTA
2. correlate adult insect flight information with local and regional weather data for each location and evaluate the utility of any existing insect population models for predicting insect life cycles.
3. adjust models if necessary and utilize them in an IPM program to more accurately time insecticide applications, achieve more effective insect control, and to reduce unnecessary insecticide applications

Materials and Methods:

The first samples were shipped to PACE on March 7, 1994 and last samples shipped on October 12, 1994.

Black light traps (Bioquip [Gardena, CA] Model 2851 A) with 22 watt black lights (Bioquip Model 2851 L) and with 120 volt AC photoelectric switches (Bioquip Model 2833A) were installed by each cooperator at a convenient site with electrical power (usually from irrigation control box or weather station) and within clear eye-shot of the turfgrass area under study. A 2-inch section of Vapona pest strip was placed in each bucket. The strip was changed monthly or sooner if live insects were found in the trap.

Insects were collected from traps by golf course personnel each Wednesday and were placed in mailing envelopes which were in turn placed in cardboard boxes for shipment to PACE Consulting. Weekly reports identifying the presence and abundance of the pest insects in Table 1 were provided to each cooperator via FAX by PACE Consulting.

Weather data for each participating golf course was obtained from the closest CIMIS station.

A study to monitor turf for cutworm and armyworm larvae was initiated at Leisure World, Laguna Hills on May 20, 1994. Weekly samplings from 9 different tees were made from May 20 - July 8, 1994. Prior to sampling, turf was treated with 5 gallons of water containing 2 ounces of Hydrowet surfactant. Following this application,

visual observations were made on the number of caterpillar larvae rising to the surface of the turf over a 10 square foot area.

Results and Discussion:

Insect counts from each participating golf course are presented in graphic form (see Appendix B). At several courses, samples were not collected on a weekly basis due to inclement weather, wet samples, failure of the Vapona strip (resulting in live insects which destroyed the remaining dead insects) and even the presence of mice in the trap bucket, which also destroyed the insect samples. To avoid these conditions in the future, traps should not be placed near irrigation, and should be placed at least 4 feet off the ground. In addition, Vapona strips need to be replaced at least every month or sooner if there is evidence of live insects in the bucket. Pest insects detected in the 1994 study are listed in Table 1 and non-pest insects detected are listed in Table 2.

Table 1. Pest insects detected in 1994 study.

COMMON NAME	SCIENTIFIC NAME
Black cutworm	*Agrotis ipsilon*
Variegated cutworm	*Peridroma saucia*
Common armyworm	*Pseudalatia unipuncta*
Sod webworms	*Tehama bonifatella, Crambus sperryellus*
Black turfgrass ataenius	*Ataenius spretulus*
Aphodius spp.	*Aphodius lividus*
Chafers	*Cyclocephala* spp.
May and June beetles	*Phyllophaga* spp.

Coleopteran (Beetle) Pests Detected:

Black turfgrass ataenius (BTA) was the most damaging and most difficult to control insect detected in the 1994 study, particularly on stressed cool season turf (bentgrass, ryegrass, bluegrass and mixtures) and/or near areas of poor drainage (low spots, near sprinkler heads).

- Damage: Most participants in this study reported high levels of insect and bird damage during the period July 25 - August 8, 1994. Based on PTRI insect monitoring data for 1994, this time period coincides with high levels of cutworm and armyworm activity as well as with the peak of 2nd generation BTA larvae. The BTA second generation is the most destructive due to its high numbers, as well as to the stressed conditions of the turf during peak temperatures. Because BTA grubs are rarely seen on turf (they are very small and feed in the thatch/soil interface), the damage they cause may erroneously be attributed to cutworms. Therefore, to avoid damage from BTA in 1995, it will be important to control first generation adults or larvae in June and July (1st generation larvae will appear 2 -

4 weeks after 1st generation adults). If the first generation is effectively controlled, damage from the second generation can be significantly reduced. Participants in the 1995 insect monitoring study will receive weekly FAXES on BTA population trends that will enable them to accurately time insecticide applications against this first generation.

- Life cycle: Adult trap count data indicated that at least 3 generations of BTA adults occur in Southern California from late June to early October. This is in contrast to the 1 - 2 generations recorded for BTA in the eastern U.S., where it has been most widely studied.
- Population model: The population models currently available for prediction of BTA development were designed for temperate climates where average temperatures frequently dip below 32°F (Wegner and Niemcyzk 1981) . For this reason these models were not applicable for Southern California where average air temperatures are rarely below 50°F.
- Control of BTA: As discussed above, in golf courses with susceptible cool season turf, BTA control is critical during the first generation, which appears during June and July. Weekly insect monitoring data from PTRI should be utilized to precisely identify the timing of the 1st generation of BTA adults. At golf courses where BTA have been a problem in the past, applications of **chlorpyrifos (Dursban or Pageant)** targeted against 1st generation adults may be useful in reducing populations. However, in most situations, a pesticide application can be avoided by waiting 2 - 4 weeks after the 1st generation adult peak. At this time, monitor turf for signs of BTA larval damage -- small patches of wilted turf which eventually become irregularly shaped patches of dead turf and/or signs of bird feeding damage. Concentrate monitoring efforts in the preferred habitat for BTA larvae, which includes cool season turf, stressed turf and areas of poor drainage (low spots, near sprinkler heads). If damage is observed, make sure that grubs are actually present by digging down two inches into the soil at the interface between damaged and healthy turf. If the small ($^1/_4$" long), white, "C" shaped grubs are detected, treatment is required. Products labeled for control of BTA larvae include **trichlorfon (e.g. Dylox or Proxol)** and **chlorpyrifos (e.g. Dursban or Pageant)**. In addition, during 1995, the newly labeled product, **imidacloprid (Merit)** will be available. This product is a systemic insecticide that has been shown to be effective against BTA larvae when applied preventively -- BEFORE any signs of BTA populations or damage occur. The manufacturer (Miles) recommends a single application before egg hatch begins -- between April and August. However, because the BTA is present for such prolonged periods in Southern California, more exact timing instructions will be necessary for most effective use.

Extremely high numbers of ***Aphodius* beetles** (over 80,000 per week at one course!) were observed in one or more peaks in August and September. Despite these high numbers, and despite the similarity in appearance to the destructive

BTA, *Aphodius* adult beetle and grubs cause no damage to turf. Features which distinguish Aphodius beetles from BTA include:

- BTA adults are jet black, while *Aphodius* beetles are brown with golden stripes on the back and wings.
- The hind legs of *Aphodius* beetles have two circular rows of spiny fringes, known as **transverse carinae**, while the hind legs of BTA adults are free of carinae and are relatively smooth.

Before treating for BTA, superintendents should confirm the identity of the insects to insure that they are not treating for the non-damaging *Aphodius*.

High numbers of **chafers and May or June Beetles** were observed at all ten courses. In most cases, a single peak of adults was observed in late June and early July. While the large (1 - $1^{1}/_{2}$ inches long) white, "C" shaped larvae (grubs) of these beetles can cause damage to turf in September and October, none of the participants in the study reported any damage from chafers or June beetles in 1994.

Lepidopteran (Moth, Worm and Caterpillar) Pests Detected:

Black cutworms and common armyworms were an almost constant presence at all courses from April through September. In general, armyworms were significantly higher in numbers than cutworms.

- Damage: Larvae (caterpillars or worms) of these insects caused some damage at several courses, but populations were easily controlled through insecticide applications. Damage caused by these pests was a combination of direct feeding by insect larvae, and damage caused by birds searching for larvae. Cutworms and armyworms feed on all species of turfgrass.
- Life Cycle: Unlike the temperate areas of the Northeast where cutworms and armyworms have only three generations per year, our Southern California data from 1994 indicates that these insects were present continuously throughout the year. Insect counts during the cooler winter months were much lower, however.
- Population Model: The population models currently available for prediction of black cutworm development were designed for temperate climates where temperatures frequently dip below 32°F . For this reason these models were not applicable for Southern California where average air temperatures are rarely below 50°F.
- Monitoring for Larvae: Attempts to monitor armyworm and cutworm larval populations via the soil drench method did not provide useful information for the purposes of timing insecticide applications. During the 8 weeks that the study was conducted, only two larvae were observed across all nine tees tested. This is despite the fact that damage from larvae and/or birds was observed during this same time period. Two other superintendents also reported damage to turf, but were unable to observe worm larvae. For this reason, black light trap counts of adults and bird damage were more reliable indicators of the presence of

these pests than larval monitoring counts. Reasons for the apparent lack of correlation between larval damage and ability to detect larvae are unclear. Possible explanations include:

1. The damage observed was actually not due to cutworms and armyworms but was due either to birds searching for BTA grubs and/or birds searching for insects that were not present.
2. Cutworm and armyworm larvae are known to prefer high-mown aprons, fairways and roughs, particularly where clippings are not removed. Perhaps larvae stay in these high mown areas during the day and move to tees and greens later in the day and evening.

- Control of Cutworms and Armyworms: Because armyworms and cutworms are present almost constantly throughout the year, timing insecticide applications can be problematic. Since many effective insecticide treatments are available for worm control (**chlorpyrifos**: e.g. Dursban or Pageant; **trichlorfon:** e.g. Dylox or Proxol; **entompathogenic nematodes**, e.g. Biosafe and Biovector) superintendents are advised to delay treatments until signs of significant damage (from worms and/or from birds) are observed. Insecticide applications should be made late in the day, since larvae are most active at night. Special care should be taken to monitor for worm damage when turf is stressed due to hot weather conditions. During 1994, the period between July 25 and August 8 had the highest average air temperatures as well as the highest number of reports of insect damage.

  Cultural practices identified by Williamson and Shetlar (1994) in a recent report may also help manage worm populations. These researchers noted that black cutworm adult females laid most of their eggs on the terminal 25% of the grass blade. For this reason, most eggs are removed by daily mowing of greens and frequent mowing of tees. If this holds true for Southern California populations of black cutworms, this means that most larvae are coming from clippings near tees and greens. By removing clippings immediately from surrounds, the incidence of cutworm infestations on tees and greens might be significantly reduced.

Table 2. Non-Pest Insects Detected in 1994 Study

COMMON NAME	SCIENTIFIC NAME
Tiger moth	Family Arctiidae
Sphinx moth	Family Sphingidae
Granulate cutworm**	*Feltia subterranea*
Beet armyworm	*Spodoptera exigua*
Cabbage looper	*Trichoplusia ni*
Saltmarsh caterpillar	*Estigmene acrea*
Giant silkworm	Family Saturniidae
False darkling beetle	Family Melandryidae
Click beetle (wireworms)**	Family Elateridae
Carrion beetle	Family Silphidae
Long horned beetle	Family Cerambycidae spp.
Ground beetle*	Family Carabidae spp.
False blister beetle	Family Oedemeridae
Ten lined June beetle**	*Polyphylla decemlineata*
Variegated mud loving beetle	Family Heteroceridae
Ladybird beetles*	Family Coccinellidae
Ants**	Family Formicidae
Mosquitoes	Family Culicidae spp.
Crane fly**	*Tipula* spp.
Phorid flies	Family Phoridae
Tree frogs!!!	
1 rubber scorpion	Courtesy of Fairbanks Ranch (thanks, guys)

***** beneficial insect

****** may be turf pests in areas outside Southern California

Sod webworm and **variegated cutworm** adults were identified in black light trap samples, but only in very low numbers. Larvae (caterpillars) from these species did not appear to cause damage at any of the participating courses. However, if present in higher numbers, these species can cause significant damage.

Other (Non-Pest) Insects Detected:

Ground beetles and ladybird beetles, both beneficial insects that feed on other insect species, were observed at almost all courses. This indicates that superintendents have been making progress towards managing their use of broad spectrum insecticides. It should be noted that ground beetle adults can easily be mistaken for BTA adults. Consult your Riker mounts to help distinguish between these two insects, and to avoid an unnecessary insecticide application against a

beneficial insect. Other non-pest insects identified in black light trap samples are listed in Table 2.

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