COOPERATIVE EXTENSION
UNIVERSITY OF CALIFORNIA
RIVERSIDE, CALIFORNIA 92521

Michael P. Kenna
United States Golf Association
Green Section Research
P.O. Box 2227
Stillwater, OK 74076

October 5, 1994

Dear Mike,

I have waited until today to reply to your request for a letter outlining the future for the grant activities on the black turfgrass ataenius project, since Dr. Tim Paine was out of town. Though I am leaving U. C. Riverside to start work at the Connecticut Agricultural Experiment Station, the ataenius project can still be carried out in California. My technician, Ken Kido, has been doing most of the day-to-day work, and will be allowed to continue work on this project after being reassigned to work with Tim Paine. Tim's appointment is for research and teaching, with a research program on biology and management of ornamentals and turf insect and mite pests. I am enclosing a copy of his resume, and a letter from him regarding the USGA grant as you had requested.

Here are a couple of positive aspects for next year's work. First, Mike Villani has indicated that additional funding for next year will not be necessary; that funds not spent in 1994 will be carried forward to do the research in 1995. Secondly, Dave Smitley (Michigan State University) has volunteered to provide me with any isolates of milky disease infected black turfgrass ataenius. Since I will be in Connecticut, I may be able to collect further isolates from the Northeast (Steve Alm, in Rhode Island, may also help). This means that there are many potential sources of milky disease that can be isolated and tested against ataenius. An unexpected and fortuitous consequence of my move to Connecticut is a geographical broadening in the collaboration and effort on this black turfgrass ataenius project.

My new address in Connecticut will be:

Conn. Agric. Expt. Sta., Valley Lab
Cook Hill Rd., P.O. Box 248
Windsor, CT 06095

(203)688-3647
FAX(203)688-9479

Sincerely,

Rich Cowles

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Dr. Michael P. Kenna, Director
Green Section Research
United States Golf Association
P. O. Box 2227
Stillwater, OK 74076

5 October 1994

Dear Dr. Kenna:

I have followed Dr. Cowles' research on Black Turfgrass Ataenius since his arrival at U. C. Riverside. Initial studies on control of this insect were conducted in my laboratory prior to his arrival, but he has taken the research to a much more detailed level in recent years. He has provide me with a copy of the proposal funded by USGA and I am willing to assume responsibility for continuing the program. I will supervise the staff assigned to Dr. Cowles' research projects until a replacement is appointed for his position. I will also maintain close contact with Dr. Cowles as the results of the research are collected. I hope this will be acceptable to you and to USGA.

If there are questions, please do not hesitate to call [(909) 787-5835].

Sincerely,

Timothy D. Paine
Associate Professor and Vice Chair
Department of Entomology

Biographical Sketch
Timothy D. Paine

Education: 1973, University of California-Davis
B.A. History (Honors) , B.S. Entomology (High Honors)
1981, University of California-Davis, Ph.D

Professional Experience: 1986-1992, Assistant Professor. 1992-present, Associate Professor. Department of Entomology, University of California, Riverside. Research Areas: Integrated management of insects affecting woody ornamental landscape plants, nurserystock, and urban or recreational forests (ash whitefly. silverleaf whitefly, eugenia psyllid, peppertree psyllid, cuban laurel thrips, western flower thrips, two-spotted spider mite, eucalyptus borer, pine bark beetles); Impact of environmental stress on phytophagous insects (encelia leaf beetle, California oakworm, dusty-winged oak aphid); Insect - plant - microorganism interactions and behavioral ecology (western pine beetle, jeffrey pine beetle). Research results reported in professional society journals, trade publications, symposia, grower or commodity meetings, and continuing education courses.

Honors and Awards:
1988 U.C. Ornamental Horticulture Education Continuing Conference Service in Counties Award
1990-91 Centinela Chapter California Association of Nurserymen Research Award
1990-91 Orange County Chapter California Association of Nurserymen Research Award
1992 U.S.D.A. Distinguished Service Team Award for Environmental and Natural Resource Protection
1992. California Association of Nurserymen Annual Research Award

Selected Publications : from a total 120, including 55 reviewed scientific):

Gould, J. R., T. S. Bellows, and T. D. Paine. 1992. Evaluation of biological control of *Siphoninus phillyreae* (Haliday) by the parasitoid *Encarsia partenopea* (Walker), using life-table analysis. Biological Control 2:257-265.

Paine, T. D., J. C. Millar, T. S. Bellows, L. M. Hanks, and J. R. Gould. 1993. Integrating classical biological control with plant health in the urban forest. J. Arboriculture 19:125-130.

Grasswitz, T. R., and T. D. Paine. 1993. Effect of experience on in-flight orientation to host-associated cues in the generalist parasitoid *Lysiphlebus testaceipes*. Entomol. exper. et appl. 68:219-229.

Grasswitz, T. R., and T. D. Paine. 1993. Influence of physiological state and experience on responsiveness of *Lysiphlebus testaceipes* (Cresson) (Hymenoptera: Aphidiidae) to aphid honeydew and to host plants. J. Insect Behavior 6:511-528.

Hanks, L. M., T. D. Paine, and J. G. Millar. 1993. Host species preference and larval performance in the wood-boring beetle *Phoracantha semipunctata* F. Oecologia (Berl.) 95:22-29.

Leddy, P. M., T. D. Paine, and T. S. Bellows. 1993. Ovipositional preference of *Siphoninus phillyreae* and its fitness on seven host plant species. Entomol. exper. et appl. 68:43-50.

Bertram, S. L. and T. D. Paine. 1994. Influence of aggregation inhibitors (verbenone and ipsdienol) on landing and attack behavior of *Dendroctonus brevicomis* (Coleoptera: Scolytidae). J. Chem. Ecol. 20: 1617-1629.

Presentations: > 120 in last five years

Report to the United States Golf Association

October 3, 1994

Biological Control and Management of Black Turfgrass Ataenius
Richard S. Cowles

Objective 1. Determine BTA larval development temperature thresholds.

Work related to this objective consisted of weekly sampling of turf cores in golf putting greens and collar areas at four locations in California. Maintenance procedures, such as spraying and turf replacement with resodding have disrupted some sampling, however, our preliminary data suggest that there are at least three generations, with resultant adults emerging in early June, August, and mid-October. Sampling shall continue through 1995 to obtain a more complete picture from the field.

Efforts in 1994 to establish ataenius populations in the greenhouse were abortive, probably due to inadvertant fumigation of the greenhouse space with an insecticide. We are confident, based on our success in 1993 with establishing greenhouse-reared ataenius, that this hurdle will be overcome and that we will be able to fulfill the laboratory studies on ataenius development.

Objective 2. Determine BTA damage thresholds.

In spite of our early difficulty in finding significant ataenius populations in the field, we did find one location that had extensive patchy damage to the putting green. Samples taken from this green indicated that approximately half the root biomass masy be lost due to BTA feeding. Some superintendants are convinced that BTA may cause damage to bentgrass at populations well below my estimated threshold of 40 larvae per square foot. They may be correct, however, separating the influence of ataenius from other stress factors (such as heat and disease) for bentgrass grown out of its zone of adaptation may prove to be very difficult.

The controlled experiment set up to explore the interaction of stress with ataenius feeding has progressed well. The plots, maintained by Desert Princess County Club, have been mowed at the two heights since June and have had the two aeration treatments applied. Dr. Robert Green shall assist in evaluating the root condition of this turf (planned evaluation in late October), so that we know whether the treatments imposed on the turf have resulted in the anticipated differences in root growth.

Objective 3. Evaluating BTA pathogens.

Possibly due to our difficulty early in the season in finding suitable ataenius populations to sample, we were not able to detect any milky disease infections in the field in California. Even if we had, our mishap in rearing BTA in the greenhouse would have prevented us from testing milky disease isolates from different geographical locations.

The test of insect pathogenic nematodes was very successful. We were able to apply both *Steinernema carpocapsae* and *S. glaseri* to a bentgrass putting green, under conditions of extreme heat and insolation typical of when larvicidal treatments are applied for control of BTA. Insect pathogenic nematodes were recovered from 13 of the 18 plots at seven days following their application, and in 9 of 18 plots at 14 days following application. Pre-irrigation had no effect on improving establishment of

nematodes, and nematodes readily dispersed to adjacent untreated plots (probably through irrigation water). With the exception of two possible recoveries of *S. glaseri* at 14 days after treatment, the morphology of the recovered infective juvenile stage nematodes was consistent with that of *S. carpocapsae*.

The surprise for us was that there was any recovery: the nematodes were applied in late morning when they would have peak exposure to ultraviolet radiation, the temperatures exceeded 100°F during the day, soil temperature was 92°F at the surface and 90°F at 1" depth, and the minimum recommended irrigation was applied to wash the nematodes into the soil. Our successful recovery of these nematodes suggests that they may be useful in managing BTA. However, the application timing would have to be earlier in the season to permit time for the nematodes to effect BTA larval population reduction. Superintendents now are used to applying insecticides that take effect within one to three days, while nematodes may be most effective if allowed to cause infections and reproduce for several weeks.

Project plans for 1995 - 1996

1995

Continue weekly sampling of BTA populations in the Coachella Valley.

Establish BTA population in pots in the greenhouse so that milky disease isolates and laboratory development studies may be done.

Obtain isolates of milky disease from New York, California, Michigan, and Connecticut. Work with Dr. Michael Klein (U.S.D.A.) to identify bacterial isolates.

Continue correlation of turf quality and damage thresholds from BTA feeding.

Infest turf plots to evaluate turf condition X BTA population density interactions.

Conduct field trial of insect pathogenic nematodes applied in early June, for demonstration of biological control potential in the Coachella Valley.

1996

Complete unfinished work from 1995.

Test milky disease isolate in the field (if allowed by EPA / USDA).

Write temperature-driven development model for BTA. Provide program to USGA for distribution to interested superintendants.