>>Message from Sally J. Scrivner:W04A; to Patrice; autoforwarded on 11/04/97
>>at 13:20:04.

From: Sally J. Scrivner:W04A
Date: ## 11/04/97 13:19 ##
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Previous comments:
From: JOHN HAZEL:S24A
Date: ## 11/04/97 14:23 ##
NA's second of three STDP proposals being sent via the DG.

CEO document contents:

FHP TECHNOLOGY DEVELOPMENT PROJECT PROPOSAL
FY 1998

PROJECT STATUS: New, not previously funded.

PROJECT NUMBER: NA-98-

PROJECT TITLE: Adjusting the Federal Tomicus Quarantine for Log Movement to Millyards: How Do Tomicus Adults Disperse Within Millyards After Overwintering?

SUBJECT: Bark beetles

PROJECT OBJECTIVE: This project will elucidate spring-dispersal flight and reproductive behavior of Tomicus piniperda in millyards. Specifically, this study will answer the following question: When temperatures warm sufficiently to support spring dispersal flight and reproduction, do Tomicus adults, which are overwintering in some of the decked pine logs, tend to reproduce within the same log deck where they were overwintering, fly to other pine logs within the millyard and reproduce, and/or disperse beyond the millyard in search of host material that is suitable for reproduction?

BRIEF DESCRIPTION OF PROJECT: Tomicus piniperda, the pine shoot beetle, was discovered in July 1992 near Cleveland, Ohio. Subsequent surveys through October 1997 have found this exotic bark beetle in 224 counties in 9 US states (WI, IL, IN, MD, MI, NY, OH, PA, WV) and in 18 counties in Ontario, Canada. In November 1992, USDA APHIS initiated a federal quarantine that regulated movement of pine logs with attached bark, pine Christmas trees, and pine nursery stock.

During November to March, Tomicus adults overwinter in the thick bark of live pine trees near groundline. From March through May, adults reproduce in recently cut pine logs and stumps. From June through October the new generation of adults feed within shoots of live pine trees.

Since the original federal quarantine was imposed in November 1992, it has undergone relatively few modifications. Currently, for the logging industry, pines can be cut and shipped "freely" from regulated (infested) to unregulated (uninfested) areas only during the period July 1 to October 31. This "open season" was created because during these months Tomicus adults feed in shoots, and therefore, if all branches and foliage are left behind, there is basically no risk of transporting Tomicus to uninfested areas.

Not surprisingly, the pine logging industry has asked APHIS if changes can be made so that logs can move to unregulated areas during the months of November through June. Various proposed changes to the quarantine were recently discussed at an APHIS-sponsored meeting in Michigan in August 1997. At the heart of these discussions is the assumption that if overwintering Tomicus adults move to millyards in some of the logs then, when temperatures warm, these beetles will "almost always" reproduce in the same logs or in nearby logs within

the millyard. If true, then transporting infested pine logs to mills in uninfested areas would pose little risk of spreading Tomicus as long as all pine logs are processed before any brood adults can complete development and emerge.

This 1-year project will test the above assumption. That is, working in both operational millyards and in simulated millyards in Michigan, we will monitor Tomicus spring flight and reproductive behavior. Much of the monitoring will be conducted with the use of baited funnel traps. The traps are baited with alpha-pinene lures that are known to be highly attractive to Tomicus adults in spring when they are looking for host material in which to reproduce. Alpha-pinene is a major constituent of pine resin, and thus such lures probably signal "fresh host material" to Tomicus adults.

We will place several funnel traps both within and outside of 8-10 millyards (or their sorting yards). We will use Michigan mills that range in size from small to large. We will select mills that (1) are located within Tomicus-infested counties but which still have very low levels of Tomicus, and (2) purchase large quantities of pine from southern Michigan counties where Tomicus populations are relatively high. We will compare the numbers of Tomicus adults captured within each millyard to the numbers captured outside the millyard. If the above assumption is correct and some infested logs are present in the millyard, then theoretically we should capture Tomicus adults only in those traps that are inside the millyards. In some cases, we will place infested logs with live beetles near the center of the millyards to be certain that some Tomicus are present.

In a companion study, we will simulate a millyard and specifically utilize logs known to be infested with overwintering Tomicus adults. We will assemble at least four "millyards." In the center of these simulated millyards we will construct a deck of pine logs, many of which will be known to harbor overwintering adults. We will coat the lower 1-2 feet of each infested log with fluorescent powder so that overwintering adults will become color-coated as they emerge. Dusting is done to allow us to examine the captured beetles and determine if they were the ones that we had released. Surrounding the central infested log deck will be several other decks of uninfested logs as well as baited funnel traps. These log decks and traps will be placed at set distances from the central infested deck, e.g., 25, 50, 100, and 200 meters away. At regular intervals during spring, we will monitor the logs and traps for Tomicus adults. These studies will be conducted in Tomicus-infested counties in southern Michigan, but yet in areas that show no evidence of Tomicus in the neighboring pine forests. We will select these types of sites to reduce the chances that Tomicus adults from surroundings areas will infest our experimental log decks. However, if this were to occur, then the fluorescent powder would allow us to recognize our experimental beetles.

FHP PERSON WHO WILL LEAD THE PROJECT: James B. Hanson (NA-FHP, St. Paul)

JUSTIFICATION: Tomicus piniperda is a newly introduced insect in the United States, with potential to spread throughout all pine growing regions of North America. The current federal Tomicus quarantine is undergoing changes, and could soon allow potentially-infested pine logs to move from infested to uninfested areas within the US. As mentioned above, one of the major assumptions for allowing logs to move from infested counties to mills in uninfested areas is the belief that overwintering beetles, upon becoming active in spring, will "almost always" stay and reproduce within the millyard. It is thought by many that Tomicus would rarely, if ever, leave a millyard where there are hundreds of freshly cut pine logs. If true, then there would be little risk of moving infested logs to uninfested areas as long as all pine logs are processed within a specified time frame. If this assumption is false then moving potentially-infested pine logs to uninfested areas could inadvertently expedite spread of Tomicus to uninfested areas.

URGENCY: Information is urgently needed in 1998 to determine how Tomicus adults disperse within millyards. This type of information is needed by APHIS so that,

if warranted, the federal quarantine can be relaxed and thereby allow more free movement of pine logs. Several mills and States are asking APHIS to reconsider that portion of the quarantine that deals with log movement, and to do so as soon as possible. As Tomicus continue to spread, this concern will be raised by more and more forest industries and States. Therefore, APHIS needs to know what the likelihood is that some overwintering Tomicus adults will move outside the millyard to reproduce and thereby spread the infestation. A delay in addressing this question could result in either (1) APHIS relaxing the regulations when not warranted, or (2) APHIS not easing the regulations when they could and thereby negatively impacting the pine logging industry.

LINK TO NATIONAL FHP TECHNOLOGY DEVELOPMENT PRIORITIES: This study addresses 3 of the 4 national priorities described in the request for proposals: (1) providing forest health protection for all lands, (2) anticipating and responding to new forest health risks, and (3) managing non-indigenous pest infestations.

SCOPE OF APPLICATION: This project will provide information applicable to all nine currently infested states and one Canadian province. In addition, this information will be of value to practically all parts of the US and Canada, because sooner or later Tomicus will move throughout the continent. The keenest interest in the research proposed herein comes from mill operators and regulators in MI, WI, MD, PA, Ontario, and Quebec.

RESEARCH BASIS: Much of the basic life history and management of Tomicus in North America has been conducted by North Central Forest Experiment Station (NCFES) scientists and their cooperators (Carter et al. 1996, Haack 1997, Haack and Cavey 1997, Haack and Kucera 1993, Haack and Lawrence 1995ab, 1997ab, Haack et al. 1997, Lawrence and Haack 1995, 1997ab, McCullough and Sadof 1996, McCullough and Smitley 1995, McCullough et al. 199X). However, to our knowledge, no studies have been conducted on spring dispersal of Tomicus piniperda within millyards. Alpha-pinene is a well-recognized attractant for Tomicus adults that have completed overwintering, but it is not attractive to brood adults that emerge in summer (Haack and Lawrence 1997a). Funnel traps baited with alpha-pinene have proven to be very efficient at catching Tomicus adults. No reports on a pheromone for this beetle have yet been published. However, recent unpublished research by Darek Czokajio and Steve Teale at the State University of New York in Syracuse, suggests that Tomicus piniperda does produce a pheromone that is of short-duration (e.g., 2-3 days). If we can obtain some trial samples of this pheromone, we will use it in some of our studies. Nevertheless, we are confident that alpha-pinene alone will work well in the present study.

We plan to use fluorescent powder to coat the outer bark of logs where Tomicus adults are overwintering. Upon emergence, the beetles should pick up some of the dust particles, and thereby be color-coated when later trapped. The use of fluorescent powder to mark scolytids is well documented (Anderbrant 1985, Cook and Hain 1992, Linton et al. 1987, McMullen et al. 1988, Safranyik et al. 1992, 1995, Thoeny et al. 1992, Wollerman 1979, Zolubas and Byers 1995). Based on the habits of Tomicus adults to walk on the bark for some time before flying, we are confident that this technique will work.

METHODS:
MILLYARD STUDIES: For the millyard studies, we will specifically target 8-10 mills that (1) are in northern Michigan, (2) are in counties where Tomicus was only recently discovered, and (3) purchase large quantities of pine logs from counties in the southern Michigan where Tomicus populations are high. Criteria 1 and 2 should ensure that "background" levels of Tomicus are very low in the area surrounding each mill. Criterion 3 should increase the chances that at least some of the logs being transported to the mills are infested with overwintering Tomicus adults.

Ideally, logs that definitely contained overwintering Tomicus would be transported to each millyard to ensure that there was a source of beetles.

However, in some mills, importing infested logs would not be feasible due to (1) liability issues and (2) the possible inconvenience of having to work around specific decks of infested logs for several weeks. Therefore, for mills that wish that no additional infested logs be brought into their millyards, we will simply monitor the Tomicus populations that are naturally present. At the other mills, we will use logs that are known to contain overwintering Tomicus. We will place the infested logs within specific decks of pine logs towards the center of the millyard. The base of each log with overwintering Tomicus will be coated with fluorescent powder so that the adults will become color-coated as they emerge. Later, when the parent adult beetles are either dissected from logs or when collected in funnel traps, those that are dusted will be readily apparent.

For all millyards in the study, we will place at least 9 baited funnel traps throughout the yard in a grid-like fashion. See figure below:

```
  Millyard
-----------
| X  X  X |    X = trap
| X  X  X |
| X  X  X |
-----------
```

At some mills, logs from infested counties are kept separate from logs from uninfested counties. Special attention will be paid to log handling and sorting practices in each millyard when analyzing the Tomicus collection records. In addition to the 9 traps within each millyard, we will set out at least 16 more traps in the area immediately surrounding each mill. Traps will be placed at standard distances (e.g., 50, 100, 200, and 500 meters) in each cardinal direction. See figure below:

```
                                x  500 meters



                                x  200
                                x  100
                                x   50
          x            x   x x Mill x x   x           x
                                x
                                x
                                x



                                x
```

The traps will be placed in the field during February and March, which is prior to initiation of spring flight. Each trap will be baited with a standard alpha-pinene lure from Phero-Tech Inc. Inside the collection cup of each trap, we will place a small piece of insecticide-impregnated "no-pest strip" so that the insects die soon after entering the traps. The traps will be monitored at regular intervals throughout the period of spring flight. All captured Tomicus adults will be counted and sorted by mill, trap, and collection date. Records will also be kept for all other wood-infesting insects that are collected.

The null hypothesis is: Tomicus interception rates will not vary significantly with distance from the millyard.

SIMULATED MILLYARD STUDIES: In this study, we will construct a minimum of four "millyards" (2 locations and 2 replicates/location) in Lower Michigan where Tomicus is known to be established. We will select areas with very low Tomicus

populations in the neighboring vicinity to reduce the chances that Tomicus adults from the surrounding area will infest the experimental log decks. One potential study area is the Newaygo Experimental Forest, on the Huron-Manistee National Forests, in Newaygo County, MI.

We will locate, cut, and transport the lower trunk of several Scotch pine trees that are known to contain large numbers of overwintering Tomicus adults (at least 25-50 adults each). A few abandoned Scotch pine Christmas tree farms have been located in southern Michigan and northern Indiana where there are very high numbers of Tomicus. More than 100 heavily infested trees, 4-6 m tall, are available. Permission has been obtained from the owners to cut "as many as we want." The basal 8 feet of these trees will be used to make the "infested log decks." We will cut each tree below groundline so that we maximize the number of overwintering adults in each truck (Haack and Lawrence 1997ab).

The infested logs will be transported by truck to the study sites. Other logs used in the study will be cut from uninfested pines near the study sites. In the center of each simulated millyard, we will position the "infested deck." The infested deck will be assembled with at least 21 logs (12 uninfested logs and 9 infested logs; see diagram below).

```
      x            x = cut end of an infested log
     o o           o = cut end of an uninfested log
    x x x
   o o o o
  x x x x x
 o o o o o o
```

Satellite decks of uninfested logs will be positioned around the central infested deck. We will use at least 10 logs in each of the satellite decks as diagrammed below:

```
      o            o = cut end of an uninfested log
     o o
    o o o
   o o o o
```

We will place the satellite decks at 25, 50, 100, and 200 m from the central infested deck along each cardinal direction. If possible, we will work beyond 200 m. Along each NE, NW, SE, and SW line, we will place baited funnel traps at similar distances from the central deck. The diagram below indicates the experimental layout:

We will coat the lower trunk on each of original infested logs. Again, this will allow us to easily identify Tomicus adults that emerge from the original infested logs and move to the other log decks or get captured in the funnel traps. At 1-2 week intervals during spring, we will monitor logs for Tomicus activity and the traps for captured Tomicus adults. Insects captured in the funnel traps will collected during each visit. Captured insects will be stored in bags or vials in the freezer until examined under blacklight to identify fluorescent color-coated individuals. In the case of the log decks, we will inspect all logs in each deck for Tomicus frass (boring dust). During each inspection, we will disassemble and then reassemble each log deck. Areas of the bark where frass is accumulating (i.e., where active Tomicus gallery construction is occurring) will be marked and dated. After completion of the spring flight period, attacked logs will be dissected and examined under blacklight for the presence of fluorescent powder.

```
                    o 200 m
   x                                    x

                    o 100 m
```

```
x = funnel trap        x                           x
o = uninfested deck                o  50
                          x        o  25    x
                            x ------------ x
                             |  Infested |
          o       o        o o|           | o o     o        o
                             |    deck   |
                            x ------------ x
                          x        o        x
                                   o
                       x                           x
                                   o


                  x                                        x
                                   o
```

The null hypothesis is: Tomicus interception rates will not vary significantly with distance from the central infested log deck.

Statistical approach: The Chi-square test will be used to compare the frequency data at the 0.05 level of significance. Analyses will be conducted to compare the number of Tomicus adults collected per trap or the number of Tomicus galleries per log deck by trapping location (inside or outside the millyard) or trapping distance (25, 50, 100 m, etc.).

QA/QC: Standard quality assurance/quality control (QA/QC) procedures will be utilized. For each task, we will develop standard protocols, provide training to all field personnel, and conduct a 5% to 10% double check of each data-recording step (e.g., beetle ID, counting, data entry). Data sets will be duplicated and maintained in two separate buildings, both in hard-copy and electronic format.

MEASURE OF SUCCESS: This project will be considered successful if (1) new knowledge about Tomicus piniperda's dispersal habits within millyards is obtained, (2) if log-handling guidelines can be formulated for mills, (3) if APHIS and some of the State Departments of Agriculture incorporate the findings into their regulations, and (4) if some of the millyards within the infested areas incorporate the findings into their millyard operations.

COOPERATORS:
1. Principal investigators:
Robert Haack, Research Entomologist and Project Leader, NC-4501, East Lansing
Therese Poland, Research Entomologist, NC-4501, East Lansing
Toby Petrice, Biological Technician, NC-4501, East Lansing
James B. Hanson, Field Representative, FHP, St. Paul

2. Currently identified cooperators:
USDA APHIS field staff from various Michigan field offices,
Michigan Department of Agriculture field staff from Traverse City, MI,
Michigan Department of Natural Resources field staff from various offices,
Deborah McCullough, Dept. of Entomology, Michigan State University,
Huron-Manistee National Forests,
Christmas tree farms in Michigan (Sno-Cap) and Indiana (Dudek's Pine Country, Matthew's Christmas Tree Farm), and
Several Michigan sawmills (e.g., Mead Corporation and sorting yards, Sawyer Lumber Company, Biewer Sawmill, Pine Tech, GYM's Sawmill, Weyerhauser, Hoeberling Wood Products).

PRODUCTS: This project will lead to new knowledge about Tomicus dispersal habits within and around millyards. The major product from this new knowledge will be a series of guidelines that describe proper millyard handling of pine

logs that move from infested counties to mills in uninfested counties. Data collection will begin in spring 1998 and will be completed by late summer 1998. Data analysis and report writing will be completed by the end of Fiscal Year (FY) 1998.

PUBLICATIONS: A project report will be completed by the end of FY98. The results from this study be published in scientific journals and trade journals during FY99.

TECHNOLOGY TRANSFER: The products of this project will be transferred to regulatory officials, forest entomologists, forest health specialists, and mill managers through publications, presentations, electronic mail, and posting of the results on the Internet. As Tomicus continues to spread in the United States and Canada, we will inform regulatory personnel and pest management specialists about these findings through mailings, phone conversations, and electronic means.

PROJECT DURATION: One year - FY98.

ESTIMATED COSTS: We are requesting 20k in STDP funding to complete this study. These funds will be used to purchase funnel traps, alpha-pine lures, re-bar to support the traps, salaries for two seasonal student employees, and some travel expenses. The Insect Unit, NC-4501, will contribute at least 35k of in-kind contributions towards this project, including salaries of the NC-4501 investigators, vehicle charges, meeting costs, some travel costs, supplies, and publication costs. Another 5k of in-kind contributions (salaries, vehicle expenses, per diem) will come from field personnel of the Michigan Department of Agriculture and APHIS who are stationed in Traverse City, MI.

LONG TERM BUDGET: One year project; see below.

FY98 BUDGET REQUEST:

	FHP	Other Sources NC-4501	MDA/APHIS
Equipment to be purchased:	$13,000	$ 2,000	0
Contracting:	0	0	0
Salary:	3,000	25,000	3,000
Overhead:	2,000	0	0
Other (per diem, mileage)	2,000	8,000	2,000
Total FY 1998 request	$20,000	$ 35,000	$ 5,000

FHP funds: FHP funding will be used to purchase 300 12-unit funnel traps ($33 each), 300 alpha-pinene lures ($6 each), 300 10-ft long rebars, bent ($4 each), salary for two part-time undergraduates (GS-3 or GS-4), some travel expenses, and overhead (NCFES policy is 10% overhead). NC-4501 will cover all costs for vehicles, mileage, supplies, and salary for permanent staff. This project is expected to occupy 25% of one GS-7 Biological Technician (Toby Petrice), 20% of one GS-11 Research Entomologist (Therese Poland), and 10% of one GS-14 Research Entomologist (Robert Haack). In addition, NC-4501 will cover all meeting costs and publications costs. NC-4501 has all the necessary equipment to complete this study, including vehicles and chainsaws.

BENEFIT AND COST
TDP PRODUCTION FUNCTION

PROJECT NUMBER: NA-98-02

PROJECT COST: $60,000

PROJECT OBJECTIVE: To elucidate Tomicus spring dispersal flight and reproductive behavior in millyards. Specifically, this study will address how far Tomicus adults, which are overwintering at the base of some decked logs in millyards, disperse in spring when temperatures warm sufficiently to support flight.

ASSUMPTIONS: We believe that the benefits and costs calculations given below are based on very conservative estimates and assumptions. For instance, we considered only the impact on four mills in the uninfested counties of Michigan's Upper Peninsula for a single year. However the impacts now felt in Michigan are similar to impacts now occurring in Wisconsin, New York, Maryland, Ontario, and Quebec. As the distribution of Tomicus expands, some mills that are now affected by the quarantine will no longer be as their counties become infested. However, as the zone of infestation expands, new mills will feel the impact as they find themselves in an uninfested county while most of their traditional pine resource is in infested counties. Therefore, each year new mills will be impacted while the impact on other mills will be relaxed.

In our analysis, we have assumed that the impacted Michigan mills can overcome the shortfall in pine timber supply by purchasing pine from other more distant markets. Based on phone conversations with the timber supply managers for the two largest impacted Michigan mills, it was thought that the average price per cord would increase by at least $5. However, some mill managers fear that there is not enough pine available in the uninfested counties of Michigan and Wisconsin to keep all mills operating at full capacity. If true, some mills would be forced to operate below capacity or to shut down completely during certain time periods. However, for the sake of this analysis, we will assume that there is sufficient pine to meet the increased demand. Some general assumptions follow:

* The results of this project will be used by USDA APHIS to modify the current federal Tomicus quarantine that now restricts movement of pine logs from infested counties to uninfested areas. Relaxing the quarantine will allow pine

logs to move year-round, as long as the logs from infested areas are processed in a timely fashion and are separated from logs from uninfested areas by a minimum distance.

* Relaxation of quarantine regulations will allow mills in uninfested areas of northern Michigan to obtain logs from infested areas in lower Michigan, thus ensuring a constant inventory of pine and operation of the mill at full capacity throughout the year. Under current restrictions, mills in uninfested areas of Michigan would experience a shortfall of more than 500,000 cords of pine inventory from November 1 to June 30, forcing them to purchase logs from other sources at an increased cost.

BACKGROUND DATA:

* To ensure operating at full capacity, there are at least four mills in northern Michigan that rely heavily (>50% of pine volume) on pine logs from the infested areas of lower Michigan,

* The four affected mills typically process more than 500,000 cords of pine from the infested counties per year,

* Current Federal Quarantine regulations prohibit movement of pine logs from infested counties for 8 months of the year, from November 1 to June 30.

* The average price of pine timber from infested Michigan counties is $50 per cord, cut and delivered to the mill,

* The increased cost of competing for and transporting the limited supply of pine timber from non-local markets is estimated at $5 per cord.

EXPENDITURE AND OUTPUT VALUES (EOV) WITHOUT PROJECT: Losses incurred because of increased operating costs due to restrictions on pine log movement from infested counties during 8 months of the year: = (500,000 cords/yr) * (.67 yr) * ($5/cord additional cost) = $1,675,000 in additional costs.

EXPENDITURE AND OUTPUT VALUES (EOV) WITH PROJECT: No losses, mills are able to operate at full capacity with no additional costs.

BENEFIT (CHANGE IN EOV) ATTRIBUTABLE TO PROJECT:
$ 0 - (- $ 1,675,000) = $ 1,675,000

BENEFIT/COST RATIO: $ 1,675,000 / $ 60,000 = 28

BENEFIT ATTRIBUTABLE TO STDP: 28 * $ 20,000 = $ 560,000

PNV OF PROJECT: $ 1,675,000 - $ 60,000 = $ 1,615,000

PNV OF STDP: $ 560,000 - $ 20,000 = $ 540,000

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