

PENNSYLVANIA'S EXPERIENCES WITH MICROBIAL CONTROL
OF THE GYPSY MOTH

James O. Nichols

Chief, Division of Forest Pest Management
Bureau of Forestry
Pennsylvania Department of Environmental
Resources
34 Airport Drive, Middletown, PA 17057-5080

ABSTRACT

Pennsylvania's first experience with using Bt on insect control occurred in 1964. For the next 17 years, various projects were conducted, in cooperation with the USFS and industry, in an effort to secure operational status of Bt for gypsy moth suppression. This point was reached in 1982, and the Governor was convinced that the time was right to convert most gypsy moth suppression operations from chemical spray to Bt. In 1983, 326,000 acres of high-use areas were treated with Bt, making it the largest Bt operation on the gypsy moth undertaken to date. Suppression results were virtually on a par with formerly used chemicals, spraying objector problems dropped to near zero, and the per acre suppression cost was cheaper. Some problems with Bt still remain, and these are discussed.

My remarks in this presentation will be confined to Bt since we have no operational experience with other microbials in gypsy moth suppression. The gypsy moth virus material may at some future date prove to be operationally feasible, but it is my opinion that this is still a long way off. It doesn't match Bt in effectiveness, at least at this time.

Being an old timer with 27 years of responsibility for gypsy moth suppression in Pennsylvania, I cannot help but reflect for a minute on long-term trends. When I first came on board in 1957, DDT was under attack. The hue and cry was to switch to less offensive "soft" chemicals such as carbaryl or trichlorfon. This was finally done in the early 1960's, and for a period of time we had little or no problems with opposition to chemical spray programs. In the 1970's, however, these biodegradable chemicals came under attack. The insistence then was that we switch to Bt.

Two things should be obvious: 1) much energy has been expended uselessly in fighting the long-term and inevitable trend away from broad-spectrum chemicals. This energy should have been expended in accelerating the conversion to microbials, and 2) if you think back to your college days you might remember some professor saying that one of our ultimate goals in forest insect control must be the development and use of specific suppression materials that have little or no impact on other organisms, the environment, and on humans. We have entered this new era of micro-

bial control on a large-scale within just the past two years. Work is now accelerating at a rapid rate, witness the number of new Bt formulations that become registered every year.

In Pennsylvania, I like to think that we have never forgotten our ultimate goals. My first contact with a microbial insecticide was back around 1960, when we made a concoction of virus to use on the European pine sawfly. It worked, but its use was soon halted by EPA.

Our work with Bt began in 1964, when we sprayed several hundred acres to test its control of the fall cankerworm. Results were variable to say the least. Over the next 17 years, our experimental work with Bt was primarily on the gypsy moth. Very few years went by without some Bt spraying, but results always left something to be desired. We could kill gypsy moths, but more than one of us suspected that a 1974 Bt spray operation on 35,000 acres did nothing more than prolong the outbreak, due to the number of healthy survivors. We also had the dubious honor in 1974 of having this large Bt operation temporarily stopped by EPA for possible violation of the terms of an experimental label. This necessitated a trip to EPA headquarters in Washington to straighten the matter out, and it made us wonder who our friends were.

At this point, I would like to pay tribute to a man who has devoted his entire career to the development of microbial insecticides. During these earlier years, he never gave up hope that someday Bt would become a viable replacement for chemical sprays. I'm sure he had many frustrating experiences, but his dedication to the task never left him. He is, of course, Dr. Frank Lewis. I don't know where we would be today with Bt if Dr. Lewis had not been on the job.

In 1981, some outstanding successes began with the newer Bt formulations. In 1982, we decided to conduct a large-scale project with Bt as part of our operational program. This was done on 32,000 acres of forested residential properties in southeastern Pennsylvania. Results were as good as with chemical spraying. Twelve B.I.U.'s were used in 128 ounces of solution per acre. A polyvinyl sticker was used over much of the area but was later abandoned due to its propensity to adhere semi-permanently to automobile finishes. We also augmented the Bt spray areas with *Apanteles* parasites with good results.

Following this successful operation with Bt, we felt the time was right to recommend a major changeover in our program from trichlorfon (Dylox) to Bt, at least in all forested residential areas. Trichlorfon was becoming too expensive, and chemical spray objectors were presenting us with severe operational problems. This recommendation was approved by the Governor who, in fact, directed us to make the changeover.

In 1983, we treated 326,000 acres with Bt, involving over 3,000 separate spray blocks of forested residential properties. Twelve B.I.U.'s

were used over most of the area, with gypsy moth densities of over 1,000 egg masses per acre in building populations receiving 16 B.I.U.'s and in some cases two treatments. The significant results of this project can be described as follows:

1. The spraying objection rate of 5-10% with previously used chemicals dropped to virtually zero with Bt. Environmentalists not only ceased their attacks but applauded the conversion. The mail that did come in was mostly from pest control officials and environmentalists in other states seeking Bt efficacy data and the reasons for our changeover. It was obvious that Pennsylvania's action influenced some other states to chart a similar course.

2. Overall costs were about \$1.00 per acre lower than with previously used chemical sprays.

3. Control results with Bt were generally acceptable, with about 80% of the areas showing 70-93% larval mortality and defoliation below 30%. Overall egg mass reduction was not as good as with chemical sprays. Many areas with building populations still had unacceptable numbers of larvae, resulting in a continuing public nuisance problem. However, even in these latter cases, foliage protection was achieved.

4. In a large program, making two applications 7 to 10 days apart in critical areas presents excessive operational problems, which we must avoid if at all possible. In 1984, we will try 20 BIU's in these critical areas. An alternative for evaluation may be two applications of 12 BIU's on the same day. In general, our treatments with 16 BIU's were not significantly better than the 12 BIU treatments in the limited areas where they could be compared with equal populations. It should be noted that control problems also existed in many of these same critical areas with chemical sprays. Basically this occurs either because foliage is being consumed as fast as it is being produced, leaving little leaf surface to spray, or because later hatching larvae are being blown in a week or more after treatment.

5. Timing of Bt applications did not prove to be as critical as we had feared, but the spring of 1983 was unusual. We allowed ourselves two weeks to get the job done in each of three geographic regions of the state. Due to cool weather after general egg hatching and reduced feeding activity, we had at least three weeks for spraying in each area. In a few areas, poor control was traced to spraying too early. The ideal start time is when white oak foliage is one-third grown.

6. We attempted to evaluate spray stickers but could not come up with any concrete evidence that they improved control. In 1984, we will only use stickers if there is a threat of rain. Our plans also call for retreating an area if rain occurs within 4-6 hours of treatment.

7. Mixing Bt solutions proved to be a headache, primarily due to inadequate equipment by contractors and our need to monitor the mixing. This mixing process, on occasion, resulted in 18 hour work-days. We experienced no significant differences in the two Bt products used, Dipel 6L and Thuricide 32LV, in the matters of efficacy, cost, and ease of spraying.

8. Considerable work was done on solution rates. About three-quarters of the operational program was done with 128 ounces per acre, and the remainder with 96 ounces. No detectable differences in efficacy existed. Consequently, the 1984 program with 12 B.I.U.'s will be 96 ounces per acre. In 20 B.I.U. areas, we will use 128 ounces as insurance for good coverage. In 1983, we also conducted experiments on thirty-four 100 acre plots to test nine Bt formulations in reduced solutions and undiluted rates. Undiluted Bt, for the most part, gave unsatisfactory control, as did solutions under 96 ounces.

To reflect on where we are now with Bt in gypsy moth suppression, there is no doubt we have come a long way. However, we are not at a resting stage; perfection is the name of the game. The way to proceed should be fairly obvious. Ideally, a spray operation should utilize undiluted material in one application. I feel certain that this is within our reach, since there is no doubt that Bt will kill gypsy moths. Expedited research in spray technology must be implemented. For example, we are still using the same spray nozzles that were in use 30 years ago. Do we really know the best type of spray aircraft to use, its speed, its spraying altitude, its swath width, and atmospheric condition limits to achieve the best results? Do we know what kind of Bt coverage we're getting within tree canopies and how long it will be effective? These are the answers we now need.

I am convinced that Bt will be in our gypsy moth suppression operations for a long time. Outsiders may not appreciate the tremendous, time-consuming burden that has been lifted from our backs by not constantly being in battle with the anti-chemical spray groups and answering public concerns for safety of their health.