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# Gypsy Moth Response - Hamilton

## Reasons for Aerial Spraying and Alternatives to Aerial Spraying as Assessed by MAF

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### **Preface**

Section 1 of this report outlines the reasons for the Ministry of Agriculture and Forestry (MAF) recommending aerial spraying with *Bacillus thuringiensis* var. *kurstaki* (Btk) in Hamilton based on the capture of one male gypsy moth.

Section 2 outlines the alternatives to aerial spraying assessed by MAF.

### **Section 1:            Aerial Spray Reasoning**

#### **Reason 1:**

**There is a probability that a small undetectable population of gypsy moth is present within the immediate area of the trap where the male moth was found. Without intervention this population could rapidly increase.**

#### ***Discussion***

- The male moth captured could have mated before it was trapped.
- Other males and females from the same egg mass could have mated and the females laid new egg-masses.
- The captured moth was in good condition when found indicating that it had flown only a short distance. It is known that the male gypsy moth seldom flies more than 800 metres and it is likely that any remaining population is close to the row of oak trees where the trap was located.
- At low population level gypsy moth is very difficult to detect.
- Traps are not 100% effective in capturing every male moth.
- Aerial spraying provides the best method to cover a wide area in a short time. It is a proven eradication technique against the gypsy moth.

#### **Reason 2:**

**The male and female moth of the Asian strain fly and larvae disperse by "ballooning". These dispersal methods significantly increase the risk of rapid spread.**

#### ***Discussion***

- The female moth of the Asian strain mates first and then flies, thus increasing the chances of starting a new population outside the monitored area.
- Spread can occur through "ballooning larvae", life stages being moved through human activity, and by female flight at the end of the season.
- Over time the risk of gypsy moth being spread out of Hamilton on inanimate objects or vegetation increases (human assisted dispersal).
- Pheromone traps target the male moth and do not capture female moths.

#### **Reason 3:**

**An association with a known invasion pathway is evident, e.g. an imported used car from Japan.**

#### ***Discussion***

- DNA evidence is that the gypsy moth we caught was a Japanese variant of gypsy moth.
- There have been imports of risk goods (used vehicles and sea containers) into Hamilton.

- There have been consistent border intercepts of gypsy moth egg masses on imported used motor vehicles from Japan.
- All evidence points to an egg mass as the likely mode of entry as other life stages are too short-lived.
- A moth lives for approx 10 days, the pupal stage is 10 – 14 days. Given the moth was caught at the end of March it could not have come from Japan as a pupal lifestage because only egg masses are present during February (winter) in Japan. The same logic applies for larvae.
- Eradication complements the New Zealand gypsy moth regulatory programme of border control, surveillance and contingency planning for eradication.

**Reason 4:**

**The gypsy moth has only one life cycle each year.**

***Discussion***

- Aerial spraying uses the safest effective spray to target the caterpillar stage of the insect.
- If treatment does not take place this spring then it would be another 12 months before spraying could occur.
- If aerial spraying were delayed for one year there would be the potential for an entire life cycle to be completed thus increasing the size of the infested area and decreasing the probability of successful eradication.
- By aerial spraying this season we have the best opportunity to eradicate the gypsy moth. If we wait then the opportunity to eradicate could disappear.

**Reason 5:**

**Community disruption and the cost of eradication can be minimised by timely, effective action.**

***Discussion***

- Treating the area before significant spread can occur, will minimise the area needing to be treated.
- The smaller the area, the fewer residents will be in the treatment area.
- The current treatment area has a significant area of industrial and commercial property and fewer residential properties than might otherwise exist.
- The cost of eradication will be less over a smaller area.
- The cost of eradication is currently economically justifiable.
- Gypsy moth is viewed internationally as both an economic and environmental high impact pest.
- If not eradicated gypsy moth has potential to significantly impact urban environments.

**Conclusion**

- The goal of eradicating an introduction of the gypsy moth is to prevent it from becoming established anywhere in New Zealand.
- Aerial treatment in the spring of 2003 with Foray 48B provides the best opportunity to eradicate the gypsy moth from Hamilton thus preventing establishment within New Zealand.

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**Comparison with United States Department of Agriculture Policy**

In the United States the gypsy moth (Asian strain) threshold is one moth capture. The US policy supports aerial spraying as the main eradication method.

- Asian gypsy moth is viewed as an adverse risk that can not be tolerated.

- Eradication is conducted where the insect is not established and is a fundamental strategy in the USA gypsy moth programme.
- A single moth capture is viewed as an introduction and is an eradication-triggering event.
- Eradication in the US tends strongly towards aerial spraying.
- As an example there have been five aerial responses in Washington State based on one moth capture. The biggest response involved targeting 48,000 hectares and spanned a three-year period (1992-1994). All eradication programmes using aerial spraying have been successful.

The recommendation for aerial spraying is supported by the advice of a Technical Advisory Group.

## **Section 2: Alternatives to Aerial Spraying**

Available options assessed included biological, mechanical and chemical controls.

### **1. Do Nothing**

A no control option could well result in gypsy moth becoming established throughout New Zealand. Attempting eradication this year presents the best possible chance of success.

All Technical Advisory Group (TAG) members have rejected the no control option.

### **2. Mass-trapping**

Mass-trapping as a treatment for gypsy moth is based on the premise that if enough pheromone traps are placed in an infested area, any male moth will be trapped before it has successfully mated with a female. Trapping densities are far higher than those used in delimiting trapping (a trapping tactic used to delineate the location of an infestation).

This equates roughly to placing one trap in every front yard and one in every back yard of an average urban household. The success of a mass-trapping treatment is monitored by comparing the number and proportion of unfertilised egg masses found in the treatment area to the number and proportion of viable egg masses. If used for eradication, success is achieved when no moths are caught in the treatment area for two years after the treatment has been completed.

There are several aspects of mass-trapping that make it a poor stand alone alternative treatment for eradicating a gypsy moth population:

**2.1 Prevention of mating** - To be a successful treatment, all male moths must be caught before they reach a female. Trapping does not guarantee that the male has not mated before it was caught.

**2.2 Resources** - As noted above, the density of trapping required is extremely high and will require a large commitment of manpower and resources.

**2.3 Not a proven eradication method** - Mass-trapping in the United States and Canada has shown that it has not been able to eradicate even small populations of gypsy moth on its own.

**2.4 Requires ground spraying** - Mass-trapping proponents have conceded that in some situations, this treatment must be used with ground application of Foray 48B (Btk). Achieving adequate coverage and control through ground spraying, particularly over a large area, is nearly impossible.

NB: MAF intends to use mass trapping after aerial spraying has been completed.

### **3. Biological Controls**

Classic biological control is achieved by the successful introduction and reproduction of predators, parasites or diseases that are specific to the pest organism. Biological control is used for pests that are exotic but **established**. For the New Zealand gypsy moth situation, biological control will only work if there is a continuing, established gypsy moth population - a situation we are attempting to avoid by following the eradication strategy.

Introduction of new organisms is a long-term activity that requires careful screening to ensure that the biological control does not harm non-target native species. Since the gypsy moth is not established in New Zealand, biological control is not a viable treatment option.

Biological controls, particularly through the introduction of a fungus specific to gypsy moth, have been carried out in the established areas in eastern North America with some success. Many other organisms have been introduced as potential biological control agents for gypsy moth in eastern North

America with little, if any effect. When successful biological control agents are able to reduce pest populations to tolerable levels but do not result in eradication.

#### **4. Host Removal**

If the source of a population of gypsy moth is known and is isolated it may be possible to remove the host vegetation and eliminate the problem.

The major disadvantage of this treatment is if the source of the moths can not be isolated to a small specific area, it would be very costly, publicly unacceptable and ineffective to remove all potential host vegetation over a larger area. Rarely is it possible to pinpoint the sources of male moths caught in pheromone traps. These traps are effective at attracting moths over several hundred metres and only provide information on the general location of the population.

In Hamilton no further activity has been located and there is no point in removing any host tree, as this would be an ineffective method of eradication.

#### **5. Ground Spraying**

Ground spraying has the same constraints and disadvantages as host removal. It would be used by MAF for the initial treatment of new finds of larvae or egg masses. If the source of a population of gypsy moth is known and is isolated it may be possible to spray the host vegetation and eliminate the problem.

The major disadvantage of this treatment is if the source of the moths can not be isolated to a small specific area, it would be ineffective to ground spray all potential host vegetation over a larger area. Rarely is it possible to pinpoint the sources of male moths caught in pheromone traps. These traps are effective at attracting moths over several hundred metres and only provide information on the general location of the population.

As noted above, achieving adequate coverage and control through ground spraying, particularly over a large area, is nearly impossible.

#### **6. Gypcheck**

The gypsy moth nucleopolyhedrosis virus (NPV) is naturally occurring and is the most common cause of the decline of outbreak gypsy moth populations in the United States. Since the late 1950's scientists have been developing the use of this virus as a biological pesticide. In 1978, the product, "Gypchek" was registered by the US Environmental Protection Agency (EPA). A similar product, "Disparvirus", was developed in Canada.

Gypchek is produced by growing caterpillars on an artificial diet, infecting individuals, harvesting cadavers, and purifying the product. This method, referred to as "in vivo" production, is labour intensive and application of Gypchek is relatively expensive. Gypchek has been successfully applied as an aerial insecticide to control populations in eastern North America. The process can only produce a limited quantity of the virus and thus is not suitable for application in large areas.

It is also believed to be suitable only for high populations of gypsy moth and as it is not registered for use in New Zealand.

#### **7. Sterile Insect Technique**

The Sterile Insect Technique (SIT) involves mass production of the target insect pest species, "sterilisation" through irradiation, followed by release into the environment on a sustained basis and in sufficient numbers to achieve appropriate over-flooding ratios. "Sterile" males find and mate with fertile females, transferring infertile/defective sperm. Any male off-spring inherit sterility. Over time, the proportion of sterile males in the population builds to a level that results in the collapse of the entire population.

SIT is directed exclusively at the target species and, contrary to other biological control methods, no adverse impacts on non-target organisms have been reported. It can be integrated with other conventional and biological methods, such as parasitoids, predators and insect pathogens (biopesticides). This integration enables the application of totally biological systems for managing some of the world's most important insect pests.

As gypsy moth is not established in New Zealand, releasing additional gypsy moths into the environment is an extremely risky strategy (eg. failure of the sterilisation process would increase the population rather than reduce it). The TAG rejected the SIT. It is viewed as a possible management method should a population become established.

## **8. Egg Mass Removal**

Egg mass removal has never been considered or proven to be an effective eradication method on its own anywhere in the world.

A major disadvantage of this treatment stems from the egg laying habit of female gypsy moth. Females will deposit their eggs on nearly any stationary object and tend to select sheltered areas (e.g., crevices, under fence rails, etc.). They also will lay their eggs high in the canopy of trees making searching extremely difficult to complete adequately. Roughly half of all egg masses laid can not be reached from the ground.

The egg mass searchers are also limited by the sheer size of the area that requires searching.

## **9. Tree Banding**

Tree-banding using burlap strips or sticky bands on the trunk of trees is a method that is used in areas where the gypsy moth are permanently established to monitor larval populations and provide some protection to trees from defoliation. Gypsy moth caterpillars move down the tree trunks at daybreak to search for shelter from predators and then return to the tree crowns at nightfall. The bands intercept these migrating larvae that are then collected daily or are caught and killed in the sticky band. The advantage of this treatment is that it does not require insecticide.

Band or strip placement is extremely labour intensive - thousands of trees would have to be treated for this method to be effective. Furthermore, the bands need to be visited every day to collect and kill any larvae that are hiding under them. If they are not removed, they will crawl out at night and may not be caught again. Caterpillars generally stay in the tree crown (where there are ample hiding places) rather than migrating to the ground or the lower trunk where the bands or strips would be placed. Thus, this treatment is not effective.

These disadvantages that make it completely unsuitable for eradication and it is not a recommended treatment for use in New Zealand.

## **10. Aerial Spraying with alternatives to Foray 48B (Btk)**

There are alternatives to Foray 48B (e.g. Dimlin) available but due to the fact that:

- Foray is proven to kill gypsy moth,
- is registered for use in New Zealand,
- is considered the safest product to use in urban areas,
- is readily available, and
- is currently being used successfully in the painted apple moth programme,

the TAG recommended that no alternative sprays be pursued.

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