April 1, 1979 - September 30, 1979

Laboratory Report
Otis Methods Development Center
Gypsy Moth Laboratory
Animal and Plant Health Inspection Service
United States Department of Agriculture
Otis Air Force Base
Massachusetts
02542

April 1, 1979 - September 30, 1979

Laboratory Report
Otis Methods Development Center
Gypsy Moth Laboratory
Animal and Plant Health Inspection Service
United States Department of Agriculture
Otis Air Force Base
Massachusetts
02542

Charles P. Schwalbe	Center Director
Edward C. Paszek	Agriculturist
Victor C. Mastro	Entomologist
Robert G. Reeves	Chemist
Joyce A. Finney	Biological Technician
Winfred H. McLane	Biological Technician
Othel T. Forrester	Entomologist
Jessie J. Baker	Biological Technician
Leonard F. Kennedy	Supervisory Biological Technician
John A. Tanner	Entomologist
Joseph G. R. Tardif	Equipment Specialist
Rebecca Upton	Administrative Clerk
Madeleine E. Perry	Clerk-Typist

SUMMARY

A screening program has been initiated to identify ultra-violet opaque materials for potential use in formulation of Gypcheck. Procedural details have been worked out and 19 candidates evaluated. The following compounds effectively protected virus from UV inactivation and will be examined further: DS-49, GIV-Tan F, Cyabsorb-1988, OU-106, OU-107 and UVINUL-N35. Field tests conducted in 1978 showed two applications of Dimilin to be effective in reducing populations when applied at the rate of .0075 lb/A in 0.5 gal. However, extensive virus mortality in the check plots complicated evaluation and recommendations for reduced application rates cannot be based on the data. The 1979 field studies are incomplete at this time, but preliminary data indicate only slight control effected by Bay SIR 8514, Dimilin and Thuricide. A large number of compounds and formulations were evaluated in the laboratory. Orthene 98%, DPX-6099, Lannate, Cidial, Idinfos, Imidan and Sumithion (with various stickers), MV-716, MV-770, GCP-6788, R-52858, DPX-4710 were among those tested. It was determined that the LD_{50} of Dimilin was ca. 3×10^{-5} lb/A on seedlings in the laboratory. Thuricide 16B was tested with a number of stickers. It was found that 5% Bond is effective if allowed to "set" 2.5 hrs before exposure to rain. At 3%, Bond apparently is ineffective after "setting" 24 hrs. Spreadability of 19 emulsifiers showed Toximul HP-8-HF and Triton to have good spreading characteristics with no deterrent effects on feeding.

Intensive larval sampling in 1 acre plots treated with ground equipment showed that larval reduction can be caused by spraying but populations quickly rebound, presumably due to immigration from surrounding untreated areas. This shows the limited value of localized, spot treatments.

Flight tunnel and actograph studies showed that laboratory reared and feral males have similar response profiles to (+) disparlure.

Studies on design features of the ½ gal milk carton (MC) trap indicated that efficiency is related to a number of inter-related factors, including size of the trap, entry port size, entry port number and DDVP concentration. It was found that MC traps capture 40-50% more males than the delta trap.

The project to develop age:dosage information for sterilizing pupae was completed and led to the adoption of standardly irradiating 8-9 day old pupae with 15 krads. F_1 sterility was observed in nearly all treatments of the test. In all cases, survival of larvae in the F_2 was very low.

These results have led us to consider the release of partially sterile males as an operational alternative because of the theoretical numerical advantage of the presence of sterile males in the F_1 generation. Studies on mating behavior showed that sperm transfer and translocation within the female is similar between normal and sterilized males. Multiple mating frequency is also similar between the two groups.

The SMT project investigated effects of chilling of adults on competitiveness. Neither irradiation nor chilling appeared to reduce competitiveness and those males chilled for 48 hrs were actually captured in proportions greater than those chilled shorter periods. Periodicity of activity was atypical of normal activity and it is possible that preconditioning of pupae by photoperiodic or thermoperiodic cues influences periodicity. A number of overfloading ratio tests were conducted to determine the ratio of sterile:normal males necessary to achieve significant interaction with a feral population. These results are presently unavailable but will be completed in time to be utilized for planning field tests in 1980.

Mating disruption tests with NCR, Conrel and Hercon formulations indicated that Conrel and Hercon are similar in effectiveness and superior to the NCR microcapsules. The Conrel formulation appeared to reduce trap catch to a degree greater than Hercon and NCR materials.

Techniques for monitoring colony performance have been developed and are now applied to the rearing program on a routine basis. During the period 3.4 million larvae have been infested and 1.25 million larvae pupae and egg masses distributed to projects at the Center and 10 cooperating agencies. Cost of colony production is $22.77/1000 and SMT rearing is estimated at $13.56/1000. It was demonstrated that hatch can be appreciably increased by holding eggs under high humidity conditions.

A series of tests was conducted to evaluate sterols, fatty acids and oils on growth and reproduction. Additional of cholesterol and B-sitosterol to an oatmeal based diet supported normal growth and reproduction. Raw linseed oil and linolenic acid also resulted in normal development but linolenic acid did not support normal development of males. Females developed normally. Oatmeal diet can also be supplemented with wheat germ oil to facilitate normal growth and development.

Egg masses collected from the infestation in Oconomowoc, Wisconsin averaged 924 eggs/mass. Embryonation was 100% and hatch and survival was 92% and 99% respectively. No evidence of virus or other diseases was noted.

A series of tests were conducted to evaluate different Japanese Beetle control approaches in airports. Chemical pesticides, mass trapping bait stations and foliar sprays were evaluated. Results suggest that all of the above tactics have application in certain airport situations to minimize the regulatory risk of beetles moving on commercial aircraft.

PESTICIDE TESTING SECTION

Project Number	Project Title		Report Type	Page
GM 6.1.5	Regulatory Treatments	McLane	Interim	4
GM 8.1.1	Evaluation of Ultraviolet Screening Agents for Microbials	McLane	Interim	5
GM 8.1.2	1978 and 1979 Small Plot Field Studies Using Dimilin, Sevin, Thuricide and SIR 8514	McLane	Interim	11
GM 8.1.3	Laboratory Screening of Candidate Pesticides Against the Gypsy Moth	McLane	Interim	22
GM 8.1.5	Field Studies of Insecticides and Microbials Applied by Ground Equipment	McLane	Final	41
GM 9.1.1	Preseason Evaluation of Two Carbaryl Formulations	McLane	Final	48
GM 9.1.2	1979 Field Tests of Bay Sir 1845, Dimilin and *Bacillus thuringiensis*	Reeves	Interim	50

PHEROMONE, BEHAVIOR AND ECOLOGY SECTION

Project Number	Project Title		Report Type	Page
GM 7.2.4	Development of Laboratory Evaluation Techniques for Gypsy Moth Male Competitiveness Comparisons	Mastro	Interim	51
GM 8.2.2	Radiological Sterilization of Male Gypsy Moths	Schwalbe	Interim	52
GM 8.2.3	Gypsy Moth Mating Behavior	Schwalbe	Interim	73
GM 8.2.6	Large Capacity Milk Carton Traps - Design Improvements	Paszek	Interim	76
GM 9.2.1	Effects of Cold Treatment of Male Competitiveness	Mastro	Interim	80
GM 9.2.2	Efficacy of Different Overflooding Ratios of Sterile Males in Simulated Populations	Mastro	Interim	96
GM 9.2.3	Trial Sterile Male Tests in a Simulated Sparse Population	Mastro	Interim	97
GM 9.2.5	1979 Field Evaluation of Microdispersable Formulations of Disparlure for Mating Disruption	Schwalbe	Interim	99

PHYSIOLOGY AND MASS REARING SECTION

JAPANESE BEETLE

Project Number	Project Title		Report Type	Page
GM 6.3.6	Establishing Standards	Tanner	Interim	101
GM 7.3.4	Insect Production and Distribution	Kennedy	Interim	114
GM 8.3.2	Rearing Techniques and Production Costs	Forrester	Interim	116
GM 8.3.4	Evaluating the Sampling Techniques used to Establish Standards and Monitor Production I. Egg Sampling Techniques II. Larval Development Techniques	Tanner	Interim	117
GM 9.3.1	Laboratory Evaluation of Eggs Collected from Oconomowoc, WI Infestation	Forrester	Final	122
GM 9.3.2	Silk Removal from Gypsy Moth Pupae	Forrester	Interim	123
GM 9.3.3	The Effect of Temperature on Vitamin Pre-mix Relative to Development and Egg Hatch	Forrester	Final	124
GM 9.3.4	Alternatives to Wheat Germ in Artificial Gypsy Moth Diet	Forrester	Final	125
GM 9.3.5	Comparison and Evaluation of Rearing Techniques	Forrester	Interim	131
JB 9.1.1	Management of Japanese Beetle Populations in and Around Airports	McLane	Interim	132

Project Number: GM 6.1.5
Project Title: Regulatory Treatments
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: W. H. McLane, J. A. Finney

Because of the heavy work load during the spring of 1979 no report was submitted for period October 1, 1978 - March 31, 1979.

The main objective of this project is to develop new and improved treatment techniques that can be used in addressing the movement of regulated items from regulated areas to non-infested locations. The lack of effective treatment methods for recreational vehicles, mobile homes and lawn furniture is a major deficiency in our gypsy moth regulatory program.

No reportable work was conducted on this project during the reporting period. However, work plans will be submitted for work to be conducted during 1980.

Project Number: GM 8.1.1
Project Title: Evaluation of Ultraviolet Screening Agents for Microbials
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: W. H. McLane, J. A. Finney

This work was not reported during the period of October 1, 1978 - March 31, 1979, due to a heavy work load during the Spring of 1979.

In April 1978, a formulation of the gypsy moth nucleopolyhedrosis virus (NPV) was registered by the United States Environmental Protection Agency under the trade name "Gypchek". According to the label this formulation consists of 25.0 to 125.0 x 10^6 gypsy moth potency units per acre, 0.50 gallons of molasses, 6 ounces of Chevron spray sticker, 1.0 pounds of Shade® and 1.44 gallons of water. Gypchek should be applied by aircraft at the rate of 2 gallons per acre. Two applications separated by 7 days are recommended. Boom and nozzle systems should be designed to produce droplets in the 150-400 um range. Water pH should also be monitored and if it exceeds 7.5 or is below 5.5, sufficient acid or base should be added to adjust to neutrality. Chlorinated water must not be used in the spray formulation.

Molasses and Shade® are added to the formulation to stimulate feeding and give protection from deactivating ultraviolet radiation. The Gypchek formulation contains materials that are difficult to work with. Occasionally fibers in the molasses clog screens and nozzles. Shade does not mix well in water and will also clog screens and nozzles. Results of laboratory tests suggest that molasses gives better UV protection than Shade.

Laboratory tests have demonstrated that NPV alone when exposed to simulated sunlight is lapidly broken down. Therefore, it is important to have an effective ultraviolet absorber in Gypchek. It is equally important that a more workable formulation be developed and registered.

Using the "Chemical Marketing Report", "Farm Chemical Handbook" and "Pesticide Index" as references, a large number of UV absorbers were selected and have been received for screening. As a first step UV absorbers were tested for solubility and nearly all were insoluable in water. Testing of other common solvents indicated that acetone is the best solvent for use with most UV absorbers. These results dictated that the effect of acetone on NPV be investigated before any of these compounds could be used as part of a formulation. Table 1 presents the results of a test designed to determine the effects of acetone on the efficacy of NPV.

Table 1. Laboratory test results using acetone, water and virus against second instar gypsy moth larvae.

Formulation 1/	Days 2/ 10	16	20
NPV in water	48	75	81
NPV in acetone	38	56	69
NPV in 75% acetone - 25% water	4	11	21
NPV in 50% acetone - 50% water	25	41	61
NPV in 10% acetone - 90% water	39	63	76
Control	0	1	1

1/ Amount of material used was equivalent to 12.8 grams of active material in 2 gallons.

2/ Mortality readings made days after larvae were introduced from foliage to artificial diet.

Tests results indicate that there is little problem in using 10% acetone and NPV together for experimental work involving ultraviolet absorbers.

To develop a standard NPV dose for the comparison of all UV absorbers a dose response test was performed. The NPV was supplied by the Hamden, CT Forest Service Laboratory (Air Dried "K", 1.25 x 10^{11} PIBs/gram, LD50-36.19 mg/ml). This stock material will be used for all future NPV tests.

Table 2. Dosage response of 5 dilutions of virus when sprayed on foliage and tested against newly moulted second instar gypsy moth larvae.

Dosage	Formulation	Percent mortality After 16 days
12.8 g/a gal/a	In water	74
6.4 g/a gal/a	"	51
3.2 g/2 gal/a	"	36
1.6 g/2 gal/a	"	23
0.8 g/2 gal/a	"	19
Check	-	0

Mortality figures in Table 2 are an average of eight tests.

Based on data collected at the Hamden Laboratory, our final mortality was much lower than it should have been. This may have been due to "resistance" in the F_{20} strain of test insects. To determine if resistance was the factor we challenged 3 strains of gypsy moth with the same NPV concentration as in the previous test.

Table 3. Virus tested against 3 laboratory strains of gypsy moth larvae.

Dosage	Percent Mortality 20 days of Diet PA Strain	MA Strain	NJ (F_{20}) Strain
12.8 g/2 gal/a	90	71	71
6.4 g/2 gal/a	62	76	43
3.2 g/2 gal/a	74	50	35
1.6 g/2 gal/a	48	42	38
0.8 g/2 gal/a	49	66	21
Check	0	0	4

Test results indicate that the laboratory NJ (F_{20}) strain and the Ludlow, MA strain are more resistant to NPV than the PA strain.

A test was conducted to determine the difference in mortality when larvae exposed to NPV were reared through pupation on foliage versus artificial diet.

Table 4. Results of test insects exposed to virus reared on foliage and diet.

Dosage	Reared on	Mortality after 16 days
0.8 g/2 gal/a	Diet	35%
0.8 g/2 gal/a	Foliage	29%
Check	Diet	1%
Check	Foliage	2%

To develop a standard exposure time to use when testing UV absorbers, a series of tests was conducted using our laboratory ultraviolet light simulator with filter.

Table 5. Virus applications tested against a laboratory ultraviolet source.

Dosage	No UV 1/	15 Min.	30 Min.	60 Min.	90 Min.	120 Min.
		Percent mortality after 16 days				
12.8 g/2 gal/a	74	53	36	29	17	20
6.4 f/2 gal/a	55	22	22	25	10	5
3.2 g/2 gal/a	39	22	16	3	7	9
1.6 g/2 gal/a	24	12	15	6	12	3
0.8 g/2 gal/a	21	16	9	7	3	5
Check						

1/ Average mortality of 5 inidividual tests after 16 days.

Based on data in Tables 2 and 5, we selected a Gypchek dosage of 12.8 grams/2 gallons/acre with an ultraviolet exposure of 60 minutes. This dosage and exposure duration of ultraviolet radiation will be used to screen all experimental ultraviolet absorbers. To date, 19 experimental compounds have been screened to establish their effectiveness against ultraviolet degradation. A 25% stock solution was first formulated with each candidate material. In most cases this dilution was made with acetone. Materials were then tested on oak seedlings, using a 1%, 5% and 10% mix by volume, Gypchek was added to each mix a short time before spraying. Plants were treated in 5 replications, 20 larvae exposed to each treated plant. At the end of 3 days larvae were transferred from plants to artificial diet. Mortality readings were made on the sixteenth day following transfer to artificial diet.

Treated plants were held in an environmental chamber at 27°C with 50% relative humidity. Plants were exposed to ultraviolet light for 60 minutes. Light was provided by one black light blue Westinghouse lamp and one Westinghouse sunlamp, mounted 2-3 inches above the treated foliage. Aluminum foil directly in back of lights was used to direct the rays onto plants. A Mylar type A DuPont polyester filter was used to screen out wave lengths below 315 nanometers. Therefore, treated plants were exposed to a range of 315-400 nanometers. With each series of treatments, 5 plants treated with virus and water only were not exposed to ultraviolet light. Also, 5 additional plants treated with the virus, solvent and absorber at 10% were not treated with ultraviolet light.

Table 6. Test results with 19 experimental ultraviolet absorbers.

Material	No UV 1/	No. UV 2/	1% 3/	5% 3/	10% 3/
	Percent mortality after 16 days				
CYabsorb-248	77	48	26	18	15
CYabsorb-1988	-	48	40	47	46
DS-49	-	77	40	46	62
GIV-820042	11	15	38	22	11
GIV-82-2154	71	31	53	19	21
GIV-Tan-F	42	65	48	71	53
OU-89	-	10	5	10	9
OU-91	52	18	20	19	25
OU-92	-	3	4	1	3
OU-94	25	12	30	25	14
OU-96	75	23	9	10	8
OU-97	-	20	23	22	21
OU-99	26	18	5	22	13
OU-100	-	20	30	31	3
OU-101	88	5	18	25	2
OU-105	19	33	32	35	28
OU-106	-	55	38	43	37
OU-107	-	43	31	34	21
UVINUL-N35	56	28	44	44	36

1/ A mix of virus and water only.

2/ A mix of virus, solvent used for the absorber and the absorber at 10%.

3/ Actual percent by volume of 20% ultraviolet absorber mix. All exposed to 60 minutes of simulated ultraviolet light in the laboratory.

Some materials such as DS-49, GIV-Tan F, Cyabsorb1988, OU-106, OU-107 and Uvinul N35 show some potential as ultraviolet screening agents. Data indicate that a number of UV absorbers may have had adverse effects on the efficacy of virus. Poor performance could also be a result of formulation problems when using acetone as the solvent. A number of mixes included a combination of water and acetone. When all available materials have been screened, work will begin with the most promising compounds. These compounds will be

extensively tested against the standard registered formulation of virus, in conjunction with emulsifiers and stickers. Weathering characteristics will also be examined. A series of tests were conducted using a new formulation of the ultraviolet screen, Pro Tec.

Table 7. Test results using a new and old formulation of Pro Tec.

Formulation	Ratio Pro Tec to Water	% Mortality after 21 days	
		30 Min UV 1/	No UV 1/
NPV + Old Pro Tec 100 + H_2O	1-6	77	76
	1-3	68	82
NPV + Old Pro Tec 100 (2) + H_2O	1-6	70	78
	1-3	80	79
NPV + Old Pro Tec 100 (3) + H_2O	1-6	82	73
	1-3	78	79
NPV + New Pro Tec + H_2O	1-6	66	75
	1-3	68	64
Standard formulation	-	71	66
NPV + H_2O	-	34	72
Check	-	0	0

1/ Average of 5 tests.

All formulations of Pro Tec performed well. The new mix was no more effective than the original mix.

Project Number: GM 8.1.2
Project Title: 1978 and 1979 Small Plot Field Studies Using Dimilin, Sevin, Thuricide and SIR 8514
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: Winfred H. McLane, R. G. Reeves, J. A. Finney

Because of a heavy work load during the preparation of our last report (October, 1978 - March 1979) no report was submitted. All work for the past year will be covered in this report.

Introduction:

Once candidate insecticides have proven to be efficacious in the laboratory the more effective ones are tested on small plots under field conditions. New formulations and lower rates and dosages of registered are also tested on small field plots before going operational.

The objectives of the work reported for 1978 were; test Dimilin at lower dosages and rates of application to establish firm treatment recommendations for future regulatory and isolated infestation applications, test Dimilin 25W in an oil formulation to see how it compares to the water formulation and use Sevin 4-oil as a standard.

Materials and Methods 1978:

Aerial application tests were conducted with Dimilin and Sevin 4-oil on 30 plots, 50 acres each in size. Specific treatments evaluated are listed in Table 1.

Table 1. Summary of 1978 tests with Dimilin and Sevin 4-oil.

Material	Dosage/Rate	No. Applications	No. Plots
Dimilin 25W	0.0075 lb AI/0.5 gal/A	2	3
" "	0.015 lb AI/0.5 gal/A	2	3
" "	0.015 lb AI/0.25 gal/A	2	3
" "	0.010 lb AI/0.25 gal/A	1	6
" "	0.03 lb AI/0.25 gal/A	1	6
Dimilin 25W w/oil	0.03 lb AI/0.25 gal/A	1	6
Sevin 4-oil	1.0 lb AI/40 oz/A	1	3
Checks	-	-	6

Test plots were established in Clinton County, Pennsylvania. The population was determined to range from 273 to 4,160 egg masses per acre. Each 50 acre plot was laid out by establishing an accessible base corner and plotting boundary lines along compass headings. Markers were placed at all four corners for aircraft guidance. Within each plot, 20 prism points were established for sampling, pre- and post-spray. Sampling points were located on four parallel lines within the center 10 acres of each plot. Sampling points were similarly established in untreated check areas. All applications were made when the majority of insects were in the second instar and oak foliage was 50-75 percent expanded.

Materials were mixed and transferred into the aircraft with conventional equipment (mixing tank, pumps, hoses, measuring devices and necessary safety equipment). Mixing and spray equipment was thoroughly cleaned between each treatment to avoid adulteration.

Treatments were made with a Cessna Ag Truck aircraft equipped with a hydraulic driven impeller pump and a conventional spray system. The aircraft dispersed the material in 60 foot swaths at 120 mph approximately 30 feet above tree tops. In plots receiving double application, treatments were made 7 days apart. Details of the formulation and application parameters are summarized in Table 2.

Table 2. Application Data for 1978 Aerial Application.

Dosage	Formulation	Nozzle Type	No. Nozzles	Air Speed	Swath Width	Size Droplet	Temp.
0.0075 lb AI/0.5 g/A	Dimilin 25W	8004 flat fan	18	120 mph	60'	150 - 300μ	80°F
0.015 lb AI/0.5 g/A	Dimilin 25W	8004 flat fan	18	120 mph	60'	150 - 300μ	80°F
0.015 lb AI/0.25 g/A	Dimilin 25W	8002 flat fan	18	120 mph	60'	150 - 250μ	85°F
0.01 lb AI/0.25 g/A	Dimilin 25W	8002 flat fan	18	120 mph	60'	150 - 250μ	80°F
0.03 lb AI/0.25 g/A	Dimilin 25W	8002 flat fan	18	120 mph	60'	150 - 250μ	85°F
0.03 lb AI/0.25 g/A	Dimilin 25W with 50% H_2O + 50% Savoi oil	8002 flat fan	15	120 mph	60'	100 - 225μ	75°F
1.0 lb AI/40 oz/A	Sevin 4-oil	8003 flat fan	15	120 mph	60'	150 - 250μ	55°F

Nozzles were pointed 90° to slip stream in all treatments.

In plots receiving two applications of Dimilin, 10 oak trees at each prism point were banded with burlap. Larval counts were conducted under burlaps three times following treatment.

Table 3. Average number of larvae counted under burlap bands in plots treated with 2 applications of Dimilin. Average of 200 burlaps in each of 3 plots.

Plot No.	Dosage	Number of Live Larvae 15 days 1/	20 days	25 days
1 - 3	0.015 lb AI/0.5 g/A	28.8	2.5	0
4 - 6	0.015 lb AI/qt/A	31.6	.2	0
19, 21, 24	0.0075 lb AI/0.5 g/A	.7	.3	0
27 - 28	Check	79.5	108.5	.75 2/

1/ Number of days following second treatment.

2/ Decline mainly due to virus mortality in late instar larvae.

It was originally planned to make a defoliation survey in each plot, however, defoliation was light and not distinguishable between pre and post treatments. Therefore, defoliation estimates were not made. However, egg mass counts were conducted at each prism point location in all treatment and control plots. Those results are summarized in Table 4.

Table 4. Pre- and post-spray egg mass counts in Dimilin and Sevin spray plots, 1978.

Plots	Material	Dosage	Pre-Spray	Post-Spray	Percent Reduction
1-2-3	Dimilin 1/	0.015 lb AI/0.5 g/A	1509 2/	0.66	99.06
4-5-6	Dimilin	0.015 lb AI/qt/A	851	0	100
19-21-24	Dimilin	0.0075 lb AI/0.5 g/A	796	0	100
7-8-10 11-12-13	Dimilin + Oil	0.03 lb AI/qt/A	722	0	100
31-32-33 34-35-36	Dimilin	0.03 lb AI/qt/A	961	0.1	99.09
37-38-39 42-43-44	Dimilin	0.01 lb AI/qt/A	754	1	99.97
15-16-20	Sevin 4-Oil + Kerosene	1.0 lb AI/40 oz/A	799	1.33	99.94
14-23-27 28-40-41	Check	-	406	13	96.8

1/ Unless otherwise stated all Dimilin was mixed in water.

2/ Egg masses/acre.

Conclusions:

A general population collapse occurred in all study plots. Heavy virus mortality occurred in all plots when larvae were in the late instars. Therefore, it is not possible to base the effectiveness of various Dimilin Sevin 4-oil treatment on pre- and post-spray egg mass counts. Although post spray egg mass counts were somewhat higher in check plots, no significant differences occurred.

Because heavy virus mortality occurred during the late instars, all evaluations will be based on the first two larval counts. It is, therefore, impossible to evaluate treatment plots where burlaps were not used. However, general observations indicated that efficacy was similar when .03 lb Dimilin was formulated in water or Savol oil applied at 1 qt/A. Dimilin also performed well when applied at 0.01 lb/A in 1 qt. water.

Based on larval counts we can conclude that Dimilin gave some degree of control when applied in two applications of 0.5 gal. each at 0.0075 lb AI/A. Similar results were obtained when 0.015 lb Dimilin was applied in double applications of 1 pt or 2 qt. Based on larval counts above, we are unable to recommend the use of 0.0075 or 0.015 lb of Dimilin per acre.

1979 Field Tests:

With the use of chemical pesticides becoming increasingly restricted, it is important that acceptable alternative materials be developed. Agents such as *Bacillus thuringiensis* (Bt) have been registered for gypsy moth control for a number of years but have rarely been used, mainly because of inconsistent results rendered.

During 1979, fifteen 50 acre plots were treated with Thuricide 16B and Thuricide 24B. An early treatment with Dimilin was made on three 50 acre plots and SIR 8514, an experimental growth regulator was also tested on 3 plots.

Materials and Methods 1979:

The test materials were supplied by Sandoz, Inc. and Mobay Chemical Company. Thuricide was delivered to the mixing site in 55 gallon drums. SIR 8514, an experimental growth regulator from Mobay was delivered as a wettable powder. Details of the experimental program are summarized in Table 1.

Table 1. Summary of 1979 field tests with Thuricide, Dimilin and SIR 8514.

Material	Dosage	No. Appl.	Date	Plot No.	Pre spray egg masses/A
Dimilin 25W	0.03 lb AI/A 1/	1	5/3	1-3	143
Thuricide 16B	8 BIU/A 2/	2	5/15-5/31	15-17	63
Thuricide 16B	8 BIU/A 3/	2	5/15-5/31	12,22,23	27
Thuricide 24B	8 BIU/A 3/	2	5/17-5/31	8,20,21	80
Thuricide 24B Not Centrifuged	8 BIU/A 3/	2	5/18-5/30	7,9,13	33
Thuricide 16B	8 BIU/A 3/	1 4/	5/27	10,11,19	23
SIR 8514	0.03 lb AI/A 2/	1	5/20	4-6	173
Checks	-	-	-	14,18 24,27	68

1/ Treatment made when 50 percent of egg masses had hatched out.

2/ Applied in 0.5 gal/A.

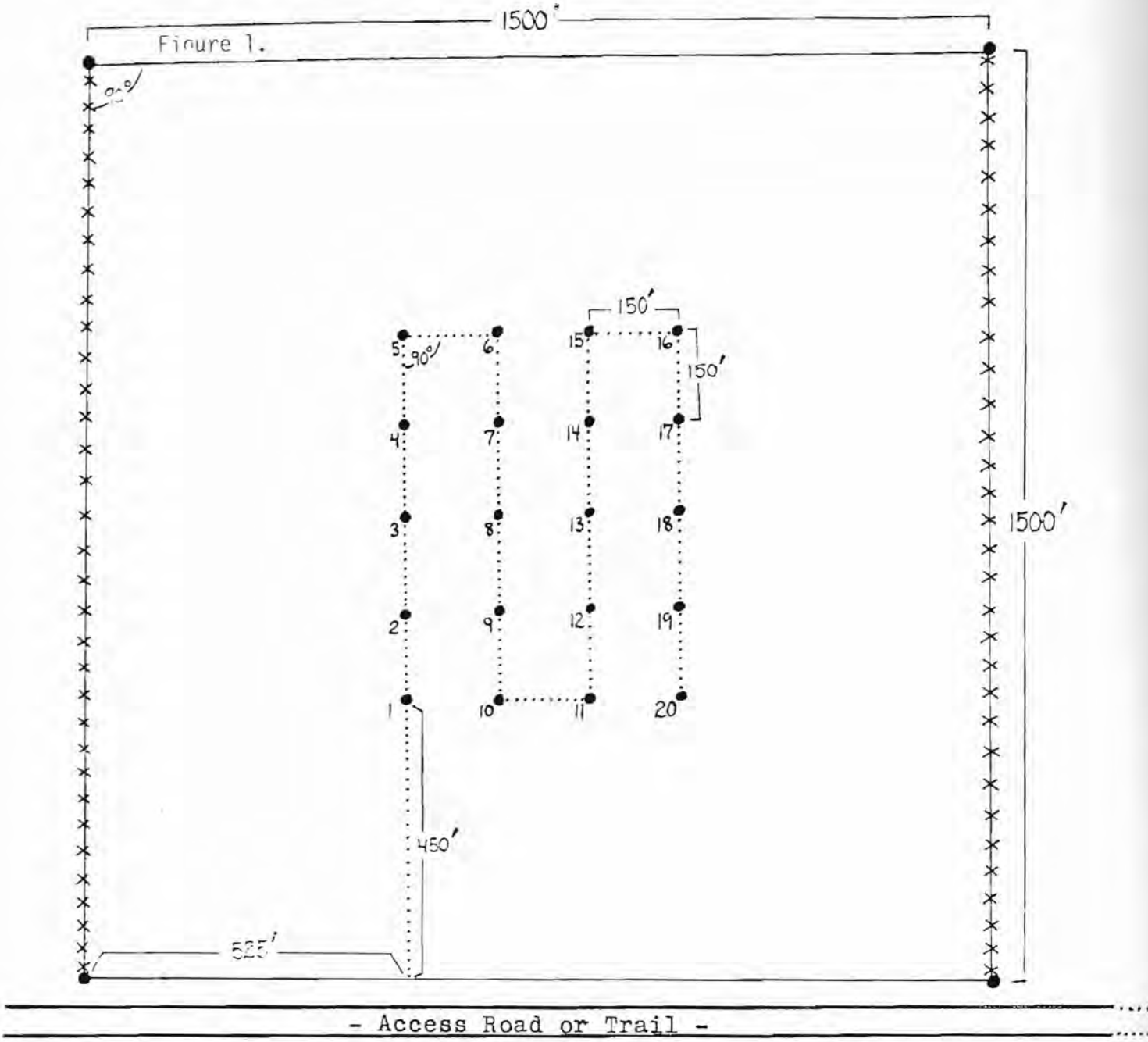
3/ Applied in 0.75 gal/A.

4/ Application was to be two applications on 4th instar larvae.

Test plots were established near W. Milford, NJ in Passaic County. All spray plots and checks were located within bounds of the "Newark Watershed Conservation and Development Corporation". This met with the approval of the Watershed Commission and the City of Newark.

All spray plots were 50 acres in size and adjacent plots were separated by at least 500 feet. Within the central 10 acres of each plot, a rectangular grid of 20 equidistant prism points was constructed for the purpose of egg mass, larval and pupal sampling procedures. At time of treatment each corner of the spray plot was marked for navigational assistance by a helium filled yellow balloon.

Figure 1. Standard 50 square acre spray plot layout.



× - Single Orange Ribbon Flags at 25' Intervals

• - Plot Corner (identified with double orange ribbon flag and luggage tag labeled NE, SE, NW or SW.)

⋮ - Single Pink Ribbon Flags at 25' Intervals

• - Prism Point (identified with double pink ribbon flag and luggage tag labeled with point number.)

Application:

Mixing and aircraft operations were conducted out of Greenwood Lake Airport, West Milford, NJ. The application schedule was designed so that the first application of Thuricide and the one application of SIR 8514 would be applied when the majority of larvae were in the second instar. The second application of Thuricide was to be made 10 days following the first. Because of weather and aircraft scheduling, our second application of Thuricide was not applied until 12-18 days following the first treatment.

The early Dimilin application was scheduled to determine the effects of a treatment when egg masses were 50 percent hatched and no foliage present. Tests during 1974 indicated that Dimilin could be effective against gypsy moth larvae when sprayed prior to foliage development.

Materials were mixed and transferred into the aircraft with conventional equipment (mixing tank, pumps, hoses, measuring devices and necessary safety equipment). All mixing and spraying equipment was thoroughly cleaned between each treatment to avoid adulteration.

All spray plots were treated with a Cessna Ag Truck aircraft except for the second application of Thuricide. Due to aircraft scheduling, a helicopter was contracted to make the second application of Thuricide. Application data are summarized in Table 2.

Table 2. Application data for 1979 aerial treatments.

Material	Dosage	Nozzle	No. Nozzle	Air Speed	Swath Width	Temp.
SIR 8514	0.03 lb AI/A 1/	8004	18	120	60'	90°F
Dimilin	0.03 lb AI/A 1/	8004	18	120	60'	60°F
Thuricide 16B	8 BIU/A 1/	8004	24	120	60'	90°F
	"	8004	8	30	80'	80°F
Thuricide 16B	8 BIU/A 2/	8006	18	120	60'	90°F
	"	8006	8	50	80'	79°F
Thuricide 24B	8 BIU/A 2/	8006	18	120	60'	67°F
Centrifuged	"	8004	8	50	80'	76°F
Thuricide 24B	8 BIU/A 2/	8006	18	120	60'	50°F
Not centrifuged	"	8004	8	50	80'	76°F
Thuricide 16B	8 BIU/A 2/ (4th instar)	8006	18	120	60'	44°F

1/ Applied in 0.5 gal.

2/ Applied in 0.75 gal.

At each prism point a total of 10 oak trees were banded with burlap bands to evaluate larval mortality. Results are summarized in Table 3.

Table 3. Larval counts in treated and check plots.

Material	Dosage	Days after Treatment	No. Larvae 1/
SIR 8514	0.03 lb AI/A 2/	33	862
Dimilin	0.03 lb AI/A 2/	42	2,455
Thuricide 16B	8 BIU/A 3/	26	2,180
Thuricide 16B	8 BIU/A 2/	34	1,072
Thuricide 24B centrifuged	8 BIU/A 3/	20	2,581
Thuricide 24B not centrifuged	8 BIU/A 3/	28	2,413
Thuricide 16B	8 BIU/A 3/ 4/	33	1,126
Checks	-	-	3,908

1/ Average of 3 plots each treatment and 200 burlaps per plot, 10 at each prism point. Control average of 6 plots.

2/ Applied in 0.5 gal.

3/ Applied in 0.75 gal.

4/ Three plots received one application against 3rd and 4th instar larvae.

Conclusions:

Although final evaluation of the effectiveness of each treatment will be determined from fall egg mass counts, large numbers of healthy larvae under burlap bands 4 to 5 weeks following treatment is not a good sign. Based on the number of larvae present in the Dimilin plots following treatment, we would have to say that this treatment was not effective. In the SIR 8514 plots there was more larval activity than expected following treatment.

A final report will be published in the October 1, 1979 - March 31, 1980 laboratory report.

Project Number: GM 8.1.3
Project Title: Laboratory Screening of Candidate Pesticides Against the Gypsy Moth
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: W. H. McLane, J. A. Finney

This work was not reported in the Laboratory Report of October 1, 1978 - March 31, 1979.

The objective of this laboratory screening project was to collect and evaluate mortality data using experimental and registered compounds potentially useful against the gypsy moth. Suitable materials were selected for field evaluation based on results of this project. Unless otherwise states, the following tests were conducted by standard techniques, using oak seedlings and 2nd instar larvae.

Several tests were conducted to compare Orthene® 75S with a new 98% material. In the future, Chevron plans to produce only 98% material in order to avoid inert ingredients that settle out rapidly.

Table 1. Mortality of second instar gypsy moth larvae when challenged with Orthene 75S and Orthene® 98.

Dosage	Rain	Percent Mortality after 3 days 75S	98%
1.0 lbs AI/ac	-	100	100
1.0 lbs AI/ac	1"	59	79
1.0 lbs AI/ac	2"	44	42
1.0 lbs AI/ac	3"	54	43
0.5 lbs AI/ac	-	99	100
0.5 lbs AI/ac	1"	59	26
0.5 lbs AI/ac	2"	41	19
0.5 lbs AI/ac	3"	32	2
0.25 lbs AI/ac	-	99	97
0.25 lbs AI/ac	1"	25	11
0.25 lbs AI/ac	2"	17	21
0.25 lbs AI/ac	3"	28	1
0.125 lbs AI/ac	-	99	95
0.125 lbs AI/ac	1"	13	3
0.125 lbs AI/ac	2"	4	2
0.125 lbs AI/ac	3"	4	3
Control		0	0

All applications were made at the rate of 1 gallon per acre.

The data indicate little difference in activity between the two formulations. The 98% technical material mixed very well in water. However, when exposed to rainfall, the active material of both formulations was lost. Consequently, tests were conducted using a number of stickers with each formulation.

Table 2. Mortality of 2nd instar gypsy moth larvae when challenged with Orthene 75S and Orthene 98 with the addition of selected stickers.

Dosage	Sticker	Rain	Percent Mortality after 4 days 75S	98%
0.5 lbs AI/ac	NuFilm 17	2"	95	98
0.5 lbs AI/ac	Chevron	2"	47	11
0.5 lbs AI/ac	Rhoplex	2"	39	20
0.5 lbs AI/ac	Plyac	2"	28	69
0.25 lbs AI/ac	NuFilm 17	2"	34	87
0.25 lbs AI/ac	Chevron	2"	40	9
0.25 lbs AI/ac	Rhoplex	2"	5	9
0.25 lbs AI/ac	Plyac	2"	20	50
Control			0	0

All applications were made at the rate of 1 gallon per acre.

The concentration of sticker was 3 percent in all tests.

A series of tests were conducted with DPX-6099, a new experimental material from DuPont.

Table 3. Standard tests comparing DPX-6099 with Lannate® L.

Dosage	Rain	Mortality after 4 days DPX-6099	Lannate L
2.0 lbs AI/ac	-	100	100
2.0 lbs AI/ac	2"	97	88
1.0 lbs AI/ac	-	100	100
1.0 lbs AI/ac	2"	99	93
0.5 lbs AI/ac	-	98	100
0.5 lbs AI/ac	2"	93	93

Table 3. (Cont'd)

Dosage	Rain	Mortality after 4 days DPX-6099	Lannate L
0.25 lbs AI/ac	-	94	100
0.25 lbs AI/ac	2"	84	34
0.125 lbs AI/ac	-	98	99
0.125 lbs AI/ac	2"	98	33
0.062 lbs AI/ac	-	99	99
0.062 lbs AI/ac	2"	89	9
Control	-	0	0

All applications were made at 1 gallon per acre.

Dimilin that was stored in the trailer at ambient temperatures for one year was bioassayed. This material was used in the 1979 field spray program.

Table 4. Bioassay of stored Dimilin.

Dosage	Mortality after 7 days Trailer Sample	Lab. Sample
0.03 lbs AI/ac	99	99
0.003 lbs AI/ac	95	96
0.0004 lbs AI/ac	68	60
0.00006 lbs AI/ac	0	1
Control	0	0

All applications were made at 1 gallon per acre.

Cidial was tested at various dosages and weathered with and without a sticker.

Table 5. Test results using Cidial against 2nd instar gypsy moth larvae.

Dosage	Sticker	Rain	Mortality after 6 days
1.0 lbs AI/ac	-	-	100
1.0 lbs AI/ac	-	1"	100
1.0 lbs AI/ac	Chevron 3%	1"	92
0.5 lbs AI/ac	-	-	100
0.5 lbs AI/ac	-	1"	100
0.5 lbs AI/ac	Chevron	1"	67

Table 5. (Cont'd)

Dosage	Sticker	Rain	Mortality after 6 days
0.25 lbs AI/ac	-	-	100
0.25 lbs AI/ac	-	1"	94
0.25 lbs AI/ac	Chevron 3%	1"	36
0.125 lbs AI/ac	-	-	100
0.125 lbs AI/ac	-	1"	30
0.125 lbs AI/ac	Chevron 3%	1"	37
0.062 lbs AI/ac	-	-	100
0.062 lbs AI/ac	-	1"	1
0.062 lbs AI/ac	Chevron 3%	1"	9
Control	-	-	0

All applications were made at 1 gallon per acre.

Table 6. Test results with Idinfos.

Dosage	Sticker	Rain	Mortality after 5 days
1.0 lbs AI/ac	-	-	100
1.0 lbs AI/ac	-	1"	10
1.0 lbs AI/ac	-	3"	46
1.0 lbs AI/ac	Chevron 3%	1"	69
0.5 lbs AI/ac	-	-	100
0.5 lbs AI/ac	-	1"	16
0.5 lbs AI/ac	-	3"	21
0.5 lbs AI/ac	Chevron 3%	1"	50
0.25 lbs AI/ac	-	-	78
0.25 lbs AI/ac	-	1"	6
0.25 lbs AI/ac	-	3"	19
0.25 lbs AI/ac	Chevron 3%	1"	28
0.125 lbs AI/ac	-	-	75
0.125 lbs AI/ac	-	1"	1
0.125 lbs AI/ac	-	3"	7
0.125 lbs AI/ac	Chevron 3%	1"	12

Table 6. (Cont'd)

Dosage	Sticker	Rain	Mortality after 5 days
0.062 lbs AI/ac	-	-	54
0.062 lbs AI/ac	-	1"	0
0.062 lbs AI/ac	-	3"	0
0.062 lbs AI/ac	Chevron 3%	1"	2
Control	-	-	0

All applications were made at 1 gallon per acre.

Efficacy tests were conducted using Imidan and a number of stickers.

Table 7. Imidan tested with various stickers.

Dosage	Sticker	Rain	Mortality after 6 days
1.0 lbs AI/ac	Rhoplex B15	2"	100
1.0 lbs AI/ac	Rhoplex B15	3"	98
1.0 lbs AI/ac	Acrylocoat	2"	100
1.0 lbs AI/ac	Acrylocoat	3"	99
1.0 lbs AI/ac	Rhoplex B60A	2"	95
1.0 lbs AI/ac	Rhoplex AC33	2"	84
0.5 lbs AI/ac	Rhoplex B15	2"	100
0.5 lbs AI/ac	Rhoplex B15	3"	98
0.5 lbs AI/ac	Acrylocoat	2"	100
0.5 lbs AI/ac	Acrylocoat	3"	99
0.5 lbs AI/ac	Rhoplex B60A	2"	97
0.5 lbs AI/ac	Rhoplex AC33	2"	93
Control	-	-	0

All applications were made at 1 gallon per acre.

All stickers were applied at 3 percent.

Tests were conducted with Sumithion and several stickers.

Table 8. Sumithion tested with various stickers.

Dosage	Sticker	Rain	Mortality after 6 days
1.0 lbs AI/ac	Rhoplex B-15	2"	99
1.0 lbs AI/ac	Rhoplex B-15	3"	100
1.0 lbs AI/ac	Acrylocoat	2"	100
1.0 lbs AI/ac	Acrylocoat	3"	99
1.0 lbs AI/ac	Rhoplex B60A	2"	99
1.0 lbs AI/ac	Rhoplex AC33	2"	98
0.5 lbs AI/ac	Rhoplex B-15	2"	100
0.5 lbs AI/ac	Rhoplex B-15	3"	100
0.5 lbs AI/ac	Acrylocoat	2"	100
0.5 lbs AI/ac	Acrylocoat	3"	100
0.5 lbs AI/ac	Rhoplex B60A	2"	99
0.5 lbs AI/ac	Rhoplex AC33	2"	99
Control	-	-	0

All applications were made at 1 gallon per acre.

Table 9. Test results with MV-716 against gypsy moth larvae.

Dosage	Mortality after 14 days
2.0 lbs AI/ac	0
1.0 lbs AI/ac	1
0.5 lbs AI/ac	1
0.25 lbs AI/ac	2
0.12 lbs AI/ac	0
Control	0

All applications were made at 1 gallon per acre.

A limited test was conducted to establish the residual activity of Dylox 1.5 oil, Orthene 75S and Dimilin 25W. Fifty plants were sprayed with each material, using the standard registered dosage to control gypsy moth larvae. The plants were then held in a test chamber at 27°C. Average relative humidity was 55 percent. Each week 5 plants were exposed to 2nd instar larvae and mortality was recorded .

Table 10. Effects of aging plants treated with Dimilin, Orthene and Dylox on efficacy against 2nd instar gypsy moth larvae.

Material	Percent mortality of 2nd instar				
	1 wk 1/	2 wk	3 wk	4 wk	5 wk
Orthene 75S 1.0 lbs AI/0.5 g/ac	96	100	100	97	100
Dylox 1.5 oil 1.0 lbs AI/5.3 qt/ac	100	75	96	71	100
Dimilin 25W 0.03 lbs AI/gal/ac	94	100	84	90	100

1/ Weeks after plants were sprayed and larvae introduced onto plants. New larvae were introduced each week.

Tables 11 through 26 give data from other experiments conducted during the year.

Table 11. Tests with DPX-6099 at low dosages compared to Lannate L.

Dosage	Rain	Percent Mortality 1/		
		1 day	2 days	6 days
0.125 lb DPX-6099	-	93	99	100
0.125 lb DPX-6099	2"	78	94	100
0.125 lb Lannate	-	100		
0.125 lb Lannate	2"	14	22	72
0.06 lbs AI/ac	-	85	98	100
0.06 lbs AI/ac	2"	88	95	100
0.06 lbs AI/ac 1/	-	76	93	100
0.06 lbs AI/ac 1/	2"	3	5	9
0.03 lbs AI/ac	-	90	94	100
0.03 lbs AI/ac	2"	45	80	95
0.03 lbs AI/ac 1/	-	47	73	97
0.03 lbs AI/ac 1/	2"	0	2	3

Table 11. (Cont'd)

Dosage	Rain	Percent Mortality 1/ 1 day	2 days	6 days
0.015 lbs AI/ac	-	54	80	100
0.015 lbs AI/ac	2"	25	38	85
0.015 lbs AI/ac 1/	-	35	46	92
0.015 lbs AI/ac 1/	2"	0	0	0
Control	-	0	0	0

1/ Days after treatment.

All applications were made at 1 gallon per acre.

Table 12. Test results with DPX 4710 tested against 2nd instar larvae.

Dosage	Rain	Percent Mortality 2/ 24 hrs	72 hrs	168 hrs
0.5 lbs AI/ac	-	62	99	100
0.5 lbs AI/ac	2"	44	95	99
0.125 lbs AI/ac	-	44	98	100
0.125 lbs AI/ac	2"	34	74	91
0.062 lbs AI/ac	-	67	98	100
0.062 lbs AI/ac	2"	24	66	95
0.0312 lbs AI/ac	-	49	94	100
0.0312 lbs AI/ac	2"	27	53	86
0.015 lbs AI/ac	-	30	70	97
0.015 lbs AI/ac	2"	6	34	83
0.0075 lbs AI/ac	-	32	81	99
0.0075 lbs AI/ac	2"	0	5	33
Control	-	0	0	0

1/ Rainfall applied in the laboratory.

2/ Number of hours after larvae were introduced onto treated foliage.

All applications were made at 1 gallon per acre.

Table 13. Test results using two formulations of DPX-4710 against 2nd instar gypsy moth larvae.

Formulation	Dosage	Rain 1/	Percent Mortality 2/ 24 Hrs	72 Hrs	168 Hrs
DPX-4710 2EC	0.5 lbs AI/ac	-	60	96	99
DPX-4710 2EC	0.5 lbs AI/ac	2"	37	85	99
DPX-4710 2EC	0.5 lbs AI/ac	-	41	92	100
DPX-4710 2EC	0.5 lbs AI/ac	2"	23	77	100
DPX-4710 2EC	0.12 lbs AI/ac	-	36	87	99
DPX-4710 2EC	0.12 lbs AI/ac	2"	34	74	95
DPX-4710 2EC	0.12 lbs AI/ac	-	23	88	98
DPX-4710 2EC	0.12 lbs AI/ac	2"	20	83	100
DPX-4710 2EC	0.06 lbs AI/ac	-	16	72	98
DPX-4710 2EC	0.06 lbs AI/ac	2"	11	48	92
DPX-4710 2EC	0.06 lbs AI/ac	-	19	91	98
DPX-4710 2EC	0.06 lbs AI/ac	2"	4	51	94
DPX-4710 2EC	0.03 lbs AI/ac	-	30	62	98
DPX-4710 2EC	0.03 lbs AI/ac	2"	2	25	79
DPX-4710 2ECS	0.03 lbs AI/ac	-	22	73	96
DPX-4710 2ECS	0.03 lbs AI/ac	2"	5	24	79
DPX-4710 2EC	0.015 lbs AI/ac	-	13	41	94
DPX-4710 2EC	0.015 lbs AI/ac	2"	1	21	75
DPX-4710 2ECS	0.015 lbs AI/ac	0	6	49	92
DPX-4710 2ECS	0.015 lbs AI/ac	2"	2	16	65
DPX-4710 2EC	0.007 lbs AI/ac	-	6	20	84
DPX-4710 2EC	0.007 lbs AI/ac	2"	4	6	17
DPX-4710 2ECS	0.007 lbs AI/ac	-	7	34	92
DPX-4710 2ECS	0.007 lbs AI/ac	2"	2	4	16
Control	-	-	0	0	0

1/ Treated plants exposed to rainfall in the laboratory 2 hours after treatment.

2/ Hours following introduction of test insects to treated plants.

All applications were made at 1 gallon per acre.

A series of tests were conducted to establish sub-lethal dosages of Dimilin 25W against 2nd instar gypsy moth larvae. The standard seedling test procedure was used in all tests. After 4 days of exposure to treated plants insects were transferred to artificial diet and reared through to pupation. At time of transfer nearly all treated foliage was consumed.

Table 14. Test results using Dimilin 25W to determine a sub-lethal dosage against 2nd instar gypsy moth larvae.

Dosage	Pupae 1/	Percent Mortality 5 Days 2/	10 Days 2/	20 Days 2/
3^{-3} lbs AI/ac	-	77	100	-
10^{-3} lbs AI/ac	-	80	100	-
9^{-4} lbs AI/ac	-	65	96	99
4^{-4} lbs AI/ac	-	59	89	99
2^{-4} lbs AI/ac	5	24	56	94
1^{-4} lbs AI/ac	1	11	30	98
6^{-5} lbs AI/ac	39	0	2	55
3^{-5} lbs AI/ac	41	0	0	55
1^{-5} lbs AI/ac	83	0	0	0
2^{-6} lbs AI/ac	87	0	0	0
6^{-7} lbs AI/ac	88	0	0	0
1^{-7} lbs AI/ac	90	0	0	0
7^{-8} lbs AI/ac	79	0	0	0
Control	87	0	0	0

1/ Percent of healthy pupae from an exposure of 100 test insects (2nd instar)

2/ Days following introduction of test insects to treated plants.

All applications were made at 1 gallon per acre.

Table 15. Test results using experimental insecticide MV-770.

Dosage	Rain 1/	Percent Mortality 2/ 2 Days	4 Days
1.0 lbs AI/ac	-	100	-
1.0 lbs AI/ac	3"	-	86
0.5 lbs AI/ac	-	100	-
0.5 lbs AI/ac	3"	-	78
0.25 lbs AI/ac	-	100	-
0.25 lbs AI/ac	3"	-	72

Table 17. Test results using citrus oil as a carrier for Orthene.

Dosage	Ratio Oil to water	Percent Mortality 1/ 1 Day	2 Days	3 Days
1.0 lbs AI/ac	1 - 1	97	97	98
0.5 lbs AI/ac	1 - 1	96	100	-
0.25 lbs AI/ac	1 - 1	88	95	100
0.12 lbs AI/ac	1 - 1	85	97	99
0.06 lbs AI/ac	1 - 1	74	91	100
Control	-	0	0	0

1/ Days after the introduction of gypsy moth larvae to treated foliage.

All applications were made at 1 gallon per acre.

Table 18. Test results using the experimental insecticide MV-770 against 2nd instar gypsy moth larvae.

Dosage	Rain	Percent Mortality 1/ 2 Days	4 Days
1.0 lbs AI/ac	-	100	-
1.0 lbs AI/ac	3"	86	-
0.5 lbs AI/ac	-	100	-
0.5 lbs AI/ac	3"	78	-
0.25 lbs AI/ac	-	100	-
0.25 lbs AI/ac	3"	72	-
0.125 lbs AI/ac	-	96	99
0.125 lbs AI/ac	3"	-	35
0.06 lbs AI/ac	-	87	100
0.06 lbs AI/ac	3"	-	8
Control	-	0	0

1/ Days after the introduction of gypsy moth larvae to treated foliage.

All applications were made at 1 gallon per acre.

Table 19. Test results using Rhodamine B dye in three insecticide formulations.

Material	Dosage	Percent Mortality 1/ 4 Days	5 Days	7 Days	17 Days
Thuricide 16B No Rhodamine-B	8 BIU AI/ac	97	99		
Thuricide 16B Rhodamine-B	8 BIU AI/ac	99	100		
Dimilin 25W No Rhodamine-B	0.015 lbs AI/ac		-	100	
Dimilin 25W Rhodamine-B	0.015 lbs AI/ac		-	94	
NPV No Rhodamine-B	$1x10^{12}$ PIBs/ml	-	-	-	79
NPV Rhodamine-B	$1x10^{12}$ PIBs/ml	-	-	-	77
Control		0	0	0	0

1/ Days after the introduction of gypsy moth larvae to treated foliage.

Applications of Dimilin and Thuricide made at 0.5 gallons per acre.

Table 20. Test results using experimental material GCP 3937 against gypsy moth larvae.

Dosage	Rain	Percent Mortality 1/ 2 Days	6 Days
1.0 lbs AI/ac	-	67	100
1.0 lbs AI/ac	1"	8	18
1.0 lbs AI/ac	3"	6	9
0.5 lbs AI/ac	-	21	99
0.5 lbs AI/ac	1"	2	10
0.5 lbs AI/ac	3"	1	3
0.25 lbs AI/ac	-	15	90
0.25 lbs AI/ac	1"	1	5
0.25 lbs AI/ac	3"	0	0
0.125 lbs AI/ac	-	5	98
0.06 lbs AI/ac	-	15	29
0.03 lbs AI/ac	-	12	18
0.01 lbs AI/ac	-	0	3
0.007 lbs AI/ac	-	1	6
Control		0	0

1/ Days after the introduction of gypsy moth larvae to treated foliage.

All applications were made at 1 gallon per acre.

Table 21. Test results using experimental insecticide GCP 6788 against 2nd instar gypsy moth larvae.

Dosage	Rain	Sticker	Percent Mortality 2/ 7 Days	10 Days
0.06 lbs AI/ac	-	-	93	96
0.06 lbs AI/ac 1/	-	-	100	-
0.06 lbs AI/ac	1"	-	26	-
0.06 lbs AI/ac	3"	-	3	-
0.06 lbs AI/ac	3"	3% Chevron	94	97
0.06 lbs AI/ac	3"	3% NuFilm 17	94	98
0.03 lbs AI/ac	-	-	80	90
0.03 lbs AI/ac	-	-	93	100
0.03 lbs AI/ac	1"	-	6	-
0.03 lbs AI/ac	3"	-	2	-
0.03 lbs AI/ac	3"	3% Chevron	79	89
0.03 lbs AI/ac	3"	3% NuFilm 17	93	96
0.015 lbs AI/ac	-	-	64	70
0.015 lbs AI/ac	-	-	97	100
0.015 lbs AI/ac	1"	-	0	-
0.015 lbs AI/ac	3"	-	0	-
0.015 lbs AI/ac	3"	3% Chevron	52	73
0.015 lbs AI/ac	3"	3% NuFilm 17	76	85
Control	-	-	0	0

1/ Treatment of Dimilin 25W for standard.

2/ Days after the introduction of gypsy moth larvae to treated foliage.

All applications made at 1 gallon per acre.

Table 22. Test results using experimental insecticide GCP 7106 against 2nd instar gypsy moth larvae.

Material	Dosage	Percent Mortality 1/ 6 Days	8 Days
GCP 7106 25W	0.06 lbs AI/ac	85	100
Dimilin 25W	0.06 lbs AI/ac	96	100
GCP 7106 25W	0.03 lbs AI/ac	64	73
Dimilin 25W	0.03 lbs AI/ac	88	100
GCP 7106 25W	0.01 lbs AI/ac	33	43
Dimilin 25W	0.01 lbs AI/ac	87	100
GCP 7106 25W	0.0078 lbs AI/ac	13	15
Dimilin 25W	0.0078 lbs AI/ac	81	100

Table 22. (Cont'd)

Material	Dosage	Percent Mortality 1/ 6 Days	8 Days
GCP 7106 25W	0.0039 lbs AI/ac	0	3
Cimilin 25W	0.0039 lbs AI/ac	80	99
Control	-	0	0

1/ Days after the introduction of gypsy moth larvae to treated foliage.

All applications made at 1 gallon per acre.

Table 23. Test results using Cidial E4 against 2nd instar gypsy moth larvae.

Formulation	Dosage	Percent Mortality 1/ 3 Days	4 Days
E4	1.0 lbs AI/ac	100	-
Tech.	1.0 lbs AI/ac	100	-
E4	0.5 lbs AI/ac	96	99
Tech.	0.5 lbs AI/ac	99	100
E4	0.25 lbs AI/ac	98	99
Tech.	0.25 lbs AI/ac	93	100
E4	0.12 lbs AI/ac	100	-
Tech.	0.12 lbs AI/ac	93	99
E4	0.06 lbs AI/ac	83	95
Tech.	0.06 lbs AI/ac	56	80
Control	-	0	0

1/ Days after the introduction of gypsy moth larvae to treated foliage.

All applications made at 1 gallon per acre.

Table 24. Test results using experimental insecticide R-52858 against gypsy moth larvae.

Dosage	Rain	Percent Mortality 1/ 1 Day	3 Days	4 Days
1.0 lbs AI/ac	-	90	100	-
1.0 lbs AI/ac	3"	84	96	100
0.5 lbs AI/ac	-	79	100	
0.5 lbs AI/ac	3"	82	97	99
0.25 lbs AI/ac	-	83	99	100
0.25 lbs AI/ac	3"	63	95	96
0.12 lbs AI/ac	-	44	97	100
0.12 lbs AI/ac	3"	24	56	81
0.06 lbs AI/ac	-	31	91	97
0.06 lbs AI/ac	3"	5	13	13
Control	-	5	6	6

1/ Days after the introduction of gypsy moth larvae to treated foliage.

All applications made at 1 gallon per acre.

When it was established that 10,000 acres of forest in Pennsylvania would be treated with Thuricide 16B, tests were started to determine the necessary rate of application. Weathering tests were also conducted with this material in conjunction with several stickers (Table 25).

Table 25. Laboratory tests using Thuricide 16B against gypsy moth larvae.

Dosage-Rate	Rain	Sticker	Percent Mortality 4 Days	8 Days	10 Days
8 BIU AI/2g/a 1/	-	-	36	98	100
8 BIU AI/2g/a	2"	-	0	18	22
8 BIU AI/g/a 1/	-	-	35	90	100
8 BIU AI/g/a	2"	-	0	5	5
8 BIU AI/g/a	-	3% RA 1645	21	83	95
8 BIU AI/g/a	2"	3% RA 1645	2	8	11
8 BIU AI/g/a	-	3% NuFilm	40	87	96
8 BIU AI/g/a	2"	3% NuFilm	0	1	1
8 BIU AI/g/a	-	3% Bond	36	85	92
8 BIU AI/g/a	2"	3% Bond	0	5	9

Table 25. (Cont'd)

Dosage-Rate	Rain	Sticker	Percent Mortality 4 Days	8 Days	10 Days
8 BIU/g/a 2/	2"	5% NuFilm	0	9	9
8 BIU/g/a	2"	5% Bond	16	74	86
8 BIU/g/a	2"	5% CIB	0	0	2
8 BIU/g/a	2"	5% Target NL	0	14	21
8 BIU/g/a	2"	5% Rhoplex	2	15	20
8 BIU/g/a	2"	5% Chevron	0	7	7
8 BIU/g/a	2"	5% Mobait	0	1	1
8 BIU AI/g/a	2"	5% Plyac	0	0	0
8 BIU AI/g/a 3/	2"	3% NuFilm	0	0	0
8 BIU AI/g/a	2"	-	0	0	0
8 BIU AI/g/a	2"	3% Plyac	0	10	27
8 BIU AI/g/a	2"	3% Mobait	0	1	1
8 BIU AI/g/a	2"	3% Chevron	0	2	4
8 BIU AI/g/a	2"	3% Rhoplex	0	5	13
8 BIU AI/g/a	2"	3% Target NL	1	11	17
8 BIU AI/g/a	2"	3% CIB	0	0	8
8 BIU AI/g/a	2"	3% Bond	1	2	5
8 BIU AI/.66 g/a	-	-	37	92	100
8 BIU AI/.66 g/a	2"	-	0	1	1
8 BIU AI/.5 g/a	-	-	15	87	100
8 BIU AI/.5 g/a 4/	2"	-	0	3	4
8 BIU AI/.5 g/a	2"	3% Bond	0	0	0
8 BIU AI/.5 g/a	2"	3% Plyac	0	0	0
8 BIU AI/.5 g/a	2"	3% Chevron	0	4	12
8 BIU AI/.5 g/a	2"	3% NuFilm	0	1	13
8 BIU AI/.5 g/a	2"	3% Rhoplex	0	2	4
8 BIU AI/.5 g/a	2"	3% Mobait	1	2	3
Control	-	-	0	0	0

1/ Plants treated with rain immediately following treatment with Thuricide.

2/ Plants treated with rain 2.5 hours after being treated with Thuricide.

3/ Plants treated with rain 24 hours after being treated with Thuricide.

4/ Plants treated with rain 3 hours after being treated with Thuricide.

A number of stickers and emulsifiers were compared in preparation for their possible use in new virus formulations.

Table 26. Emulsifiers tested for spreadability characteristics.

Material	Percent Emulsifier 0.5	1.0	2.0	3.0
ADSEE 775	3 1/	4	-	4
AK 1695	3	4	-	4
Amway	2	3	4	4
Sponto H44C	1	1	1	2
Sponto 6024	3	3	4	4
Sponto 6524	3	4	4	4
Toximul HHF	3	4	4	4
Toximul 360B	3	4	4	4
Toximul HP8	3	4	4	4
Toximul BHF	3	3	4	4
Toximul MP-HF	3	3	4	4
Toximul HP-8-HF	4	4	4	4
Toximul S	3	4	4	4
Toximul H	4	4	4	4
Triton X100	4	4	-	4
Triton X180	3	4	4	4
Triton X190	3	4	-	4
Triton X301	4	4	-	4
Triton B1956	2	3	-	4

1/ Materials were rated as follows:

1 - Poor 3 - Good

2 - Fair 4 - Excellent

Emulsifiers were pipetted onto 1 inch oak seedling discs. The discs were then fed to gypsy moth larvae to investigate the repellent properties of the various materials.

Project Number: GM 8.1.5
Project Title: Field Studies of Insecticides and Microbials Applied by Ground Equipment
Report Period: April 1, 1979 - September 30, 1979
Report Type: Final
Project Leaders: Winfred H. McLane, R. G. Reeves

United States Department of Agriculture regulatory personnel conduct treatments to minimize the impact of the gypsy moth. The majority of the areas are sprayed with modern agricultural aircraft. However, where treatment acreage is small, ground equipment can sometimes be used. For example, in areas adjacent to campgrounds, trailer parks, water reservoirs and crop land, usually it is advantageous to use ground equipment.

Sevin 80S is the most common insecticide used with ground application equipment. The present gypsy moth control manual calls for the use of 11.34 kg. (25 lbs) in 189.25 liters (50 gallons) of water + a sticker. Operators use a sufficient volume of the mixture to obtain good coverage (ca. 5 gal/acre). Actual insecticide used is about 2.0 lbs/acre.

Although ground applications are normally made when spray conditions are suitable, questions of how far the effective spray deposits are distributed from the sprayer have been asked. Insect migration back into treated areas has also concerned regulatory officials. Often spray crews must retreat heavily infested areas because one application is not effective.

In 1978, 3 spray plots each 1.1 ha were established in Clinton and Lycoming counties, Pennsylvania for treatment with Sevin 80S using a truck mounted mist blower. The objective was to determine the extent of larval migration into the center .4 ha. A determination of insecticide deposition was also planned. Plots were located on state land with predominantly oak trees; gypsy moth population density was 50-500 egg mass/acre. A road ran through the center of each plot. Plots were evaluated using a grid system with sample points 25 feet (7.6 m) apart in each direction except on the road. At each point, pre-and post-spray egg mass counts were made within a circular plot with an 8.33 foot (2.5 m) radius. One live oak tree was banded with burlap at each of the 210 sample points. All burlap bands were checked for larvae, pupae and egg masses.

Sixteen 2 acre (0.4 ha) plots were also established to evaluate the efficacy of Gypchek sprayed with ground equipment. Each plot had two subplots of 33 square feet, one on each side of the road. Treatments are summarized in Table 1. Pre- and post-spray egg mass counts as well as defoliation estimates were made at each subplot (Table 2).

Table 1. Application details of Sevin 80S and Gypchek Using Ground Equipment, 1978.

Material	Dosage	Date	No. Appl.	Plot	Nozzle	Pressure
Sevin 80S	2.0 lbs AI/a 1/	6/2/78	1	A	D2	300
Sevin 80S	2.0 lbs AI/a 1/	6/2/78	1	B	D2	300
Sevin 80S	2.0 lbs AI/a 1/	6/2/78	1	C	D2	300
Gypchek	$2x10^{11}$ PU/a	5/30/78 6/6/78	2	1-3-7	D2	300
Gypchek	$5x10^{11}$ PU/a	5/30/78 6/6/78	2	2-4-6	D2	300
Gypchek	$5x10^{11}$ PU/a	6/2/78	1	5-8-10	D2	300
Gypchek	$2x10^{11}$ PU/a	6/4/78	1	9-11-13	D2	300
Checks	-	-	-	12-14 15-16	-	-

1/ Applied at 5 gallons per acre.

Table 2. Egg mass counts and defoliation estimates in Gypchek treated plots.

Dosage Rate	No. Appl.	Pre Spray E/M/A	Post Spray E/M/A	Defoliation PRE	Defoliation POST	% E/M Reduction
$2x10^{11}$ PIBS/5gal/a	2	700	33.3	0-5%	0-5%	95.3
$5x10^{11}$ PIBS/5gal/a	2	660	20	0-5%	0-5%	97
$2x10^{11}$ PIBS/5gal/a	1	900	47	0-5%	0-5%	94.8
$5x10^{11}$ PIBS/5gal/a	1	787	27	0-5%	0-5%	96.6
Checks	-	700	20	0-5%	0-5%	97.2

1/ Based on the average of two 1/40th acre subplots, one on each side of the road.

Figure 1. Average pre-spray E/M for Sevin ground plots.

	1	2	3	4	5	6	7	8	9	10	11	11	13	14
O	67	200	0	133	733	200	67	133	133	333	467	400	0	133
N	400	333	333	0	0	0	867	200	267	400	333	333	400	200
M	0	300	133	67	0	200	0	200	67	133	867	67	467	333
L	0	200	400	200	200	533	600	533	200	0	67	133	267	0
K	200	0	400	933	600	133	267	333	133	67	133	533	400	1000
J	133	600	0	333	400	133	67	267	400	267	67	67	333	67
I	67	600	267	0	400	67	467	67	67	133	467	0	267	0
H	400	67	400	267	67	333	800	67	67	200	67	200	600	267
G	133	933	0	267	600	133	267	667	0	67	267	333	600	333
F	133	267	333	800	67	67	0	67	133	333	67	133	67	267
E	267	267	733	333	533	333	200	133	200	133	67	200	67	133
D	933	600	600	267	267	67	400	267	800	133	400	0	267	867
C	133	267	600	67	200	133	200	133	133	133	133	267	267	0
B	333	667	600	467	0	267	267	467	800	200	800	67	200	0
A	133	400	1533	267	67	400	0	200	133	67	467	67	133	67

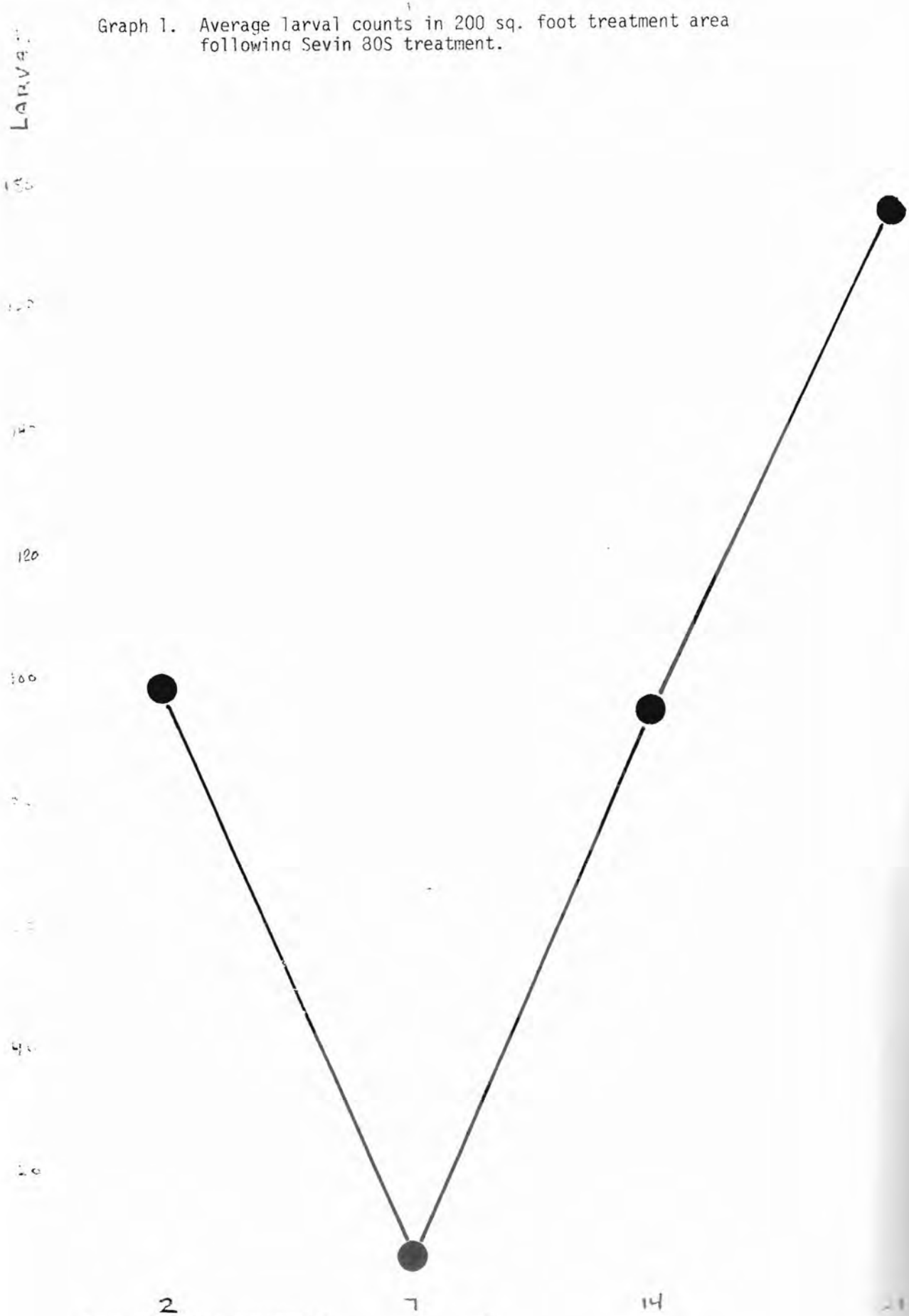
Average of plots A-B-C

. - 1 Burlap per sample point

x - Foliage sample points for gas chromatography

N

Graph 1. Average larval counts in 200 sq. foot treatment area following Sevin 80S treatment.



Days following treatments.

FIGURE 2. Post Spray Egg Mass Counts

350'

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
O	133	67	0	67	67	0	200	67	67	0	67	67	67	67
N	200	0	0	133	67	0	67	67	0	0	67	0	67	0
M	67	0	67	0	67	0	133	0	0	0	0	67	0	0
L	200	0	67	67	133	133	0	0	0	0	0	0	0	0
K	67	0	0	67	133	0	0	0	0	0	0	0	67	133
J	0	133	200	0	0	0	0	0	0	0	0	67	0	0
I	0	0	0	0	67	0	0	0	0	67	200	133	67	67
H	0	0	0	0	0	0	0	0	67	67	67	0	0	0
G	0	0	0	0	0	67	67	0	67	67	0	0	0	0
F	0	0	67	200	0	0	0	0	0	0	0	0	133	0
E	200	0	0	0	67	0	0	0	67	67	0	67	0	0
D	0	267	0	67	67	0	0	0	67	0	67	133	67	67
C	0	0	0	0	0	0	0	0	133	0	0	0	0	67
B	0	0	0	0	0	0	67	0	0	0	133	67	0	0
A	0	0	67	67	67	67	0	0	0	0	0	0	0	0

Average egg masses per acre of plots A-B-C.

N

Figures 1 - 6 represent pre and post spray egg mass counts, larval counts under burlaps and defoliation studies.

Graph 1 gives average larval counts under burlaps in 200 square foot treatment area.

Post spray egg mass counts are summarized in Figure 2.

Foliage samples were collected at or near established points throughout each plot for analysis by gas chromotography. Samples were collected at various time intervals following treatment. In the transfer of personnel, results were lost, therefore, only a general statement will be made.

Foliage collected one day after treatment had little Sevin residual. This was mainly due to heavy rain following treatment and the fact that foliage collected was removed from trees at the 3-6 foot level. Most of the active insecticide was deposited on the upper parts of the trees. It is also possible that the spray did not penetrate as deeply into the plots as was expected.

Summary:

In evaluating this study one should keep in mind that as gypsy moth larvae become larger they have a natural tendency to migrate more. This is especially true on hot days when they migrate to the lower parts of trees to seek out shade. It is therefore natural to recover larger numbers of larvae under burlap bands as the season progresses.

Because of a general population collapse in all Gypchek and control plots. it is impossible to determine the effects of ground applied Gypchek on the population. All plots including controls had a 94 percent plus reduction in egg masses. There was little difference in defoliation throughout all plots.

If Gypchek is to be used from ground equipment, work should be conducted to improve the formulation or develop a new formulation for ground equipment only. We experienced much difficulty in spraying the present formulation from a John Bean mist blower. Nozzles and main screen clogged a number of times because it was impossible to mix the formulation in the mist blower tank. We finally pre-mixed the Shade and water in a 5 gallon bucket and then dumped it into the tank followed by molasses, sticker, Gypchek and water. Working this way with all screens in the system removed we then had no problems. We therefore, got good coverage on some plots and poor on others.

In plots treated with Sevin 80S a population collapse also occurred. This collapse took place within the treated area as well as in all of the adjacent areas. Because of this it is not possible to evaluate the treatments based on egg mass reduction.

Larval counts following treatments indicate that good control was achieved within the first 100 feet of forest land on each side of the centering road. Larvae reduction was significant 7 days following treatment. The 14 day reading indicated that heavy migration into the plots developed between 7 and 14 days following treatment. Heavy rain shortly after treatment could be the cause for the limited residual.

Data indicate that when a gypsy moth population is of moderate to heavy density, that population can exert extreme pressure on an insecticide treated block within its boundaries. This pressure is a result of large migrating larvae probing into the treated area from one or all sides. Regulatory campsite and campground spraying by ground equipment are good examples of treatments that receive pressure from the adjacent infested areas. Therefore, treated areas should be checked closely following treatment and if any migration is detected a second application may be needed. By treating a wide buffer zone some migration can be eliminated from critical areas.

For additional information on this study, see Otis Laboratory Report - April 1, 1978 - September 30, 1978.

Project Number: GM 9.1.1
Project Title: Preseason Evaluation of Two Carbaryl Formulations
Report Period: April 1, 1979 - September 30, 1979
Report Type: Final
Project Leader: Winfred H. McLane

This work was not reported at the end of March 1979 because of the heavy work load at that time.

Proper mixing and application of an insecticide is very important to its final efficacy. Inefficient mixing generally means additional work for ground crews and down time for aircraft. Inadequate dispersion from application equipment also means down time, additional work and advancing insect development. Formulations that do not break up well, give poor coverage, are susceptible to sunlight and/or weather poorly, also give poor control of the target insect. The materials to be tested were Carbaryl formulation UCSF-1 and a new Sevin 4-oil formulation. The following tests were scheduled for each experimental formulation:

I. Evaluate deposition efficiency of UCSF-1 as a function of:

Variable	Levels
Altitude	10', 50', 100'
Additives	0, A
Nozzle sizes	8002, 8004, 8008
Dilutions	4:1, 1:1

II. Evaluate foaming of "low foam" UCSF-1 throughout the above series of tests.

III. Evaluate current clean-up procedures and refine as necessary.

IV. Develop calibration curves for tests conducted.

V Evaluate "New" Sevin 4-oil versus "Old" Sevin 4-oil for:

A. General handling properties (viscosity vs. shear, agglomerates, viscosity vs. temperature, spray patterns, clean-up, etc.)

B. Deposition efficiency (% deposited on target, size and uniformity of droplets on target) as a function of:

Variable	Levels
Altitude	10', 50', 100'
Nozzle size	8004
Dilution	4:1, 1:1

Although tables summarizing the trials will not be presented here, results and observations are briefly stated. The main problem with Sevin 4-oil has been the settling out of material in 55 gallon drums with ensuing difficulty in resuspension. The material has also required the addition of kerosene to help thin it down for better break-up of material.

The new Sevin 4-oil formulation handled very well; flow rate was good and kerosene was not needed for thinning of the material. After being allowed to settle for months the formulation resuspended easily. This formulation is a superior mix to the formulation presently produced and should be evaluated for field efficacy.

The UCSF-1 formulation only foamed slightly during handling. However, it showed some signs of building up on nozzle tips after 15 minutes of spraying with 8002 and 8004 flat fan nozzles. The formulation needs further modification before being field tested.

Project Number: GM 9.1.2
Project Title: 1979 Field Tests of Bay Sir 1845, Dimilin and *Bacillus thuringiensis*.
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: R. G. Reeves, W. H. McLane, J. A. Finney

A manuscript is being prepared for publication in the APHIS 81 series and will be included as a Final Report in our next semi-annual report. Preliminary results can be found in GM 8.1.2.

Project Number: GM 7.2.4
Project Title: Development of Laboratory Evaluation Techniques for Gypsy Moth Male Competitiveness Comparisons
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: V. C. Mastro, T. M. ODell

Actograph studies comparing male laboratory activity with male field activity during this past field season indicate the actograph effectively monitors male activity periodicity. Activity peaks can be correlated between laboratory and field results. The actograph is currently being used to determine what factors control male activity and how these can be manipulated. A complete report on these studies will be presented in the next semi annual report.

Flight tunnel studies indicate that laboratory-reared males and feral males show similar responses when exposed to (+) disparlure at various concentrations. The influence of rearing, handling and testing conditions (e.g. temperature, humidity, irradiation) on male pheromone response is currently being investigated. A report on these studies will be presented in the next semi annual report. The results of field tests of the findings and a complete profile of feral male pheromone responses will be included one year from this time.

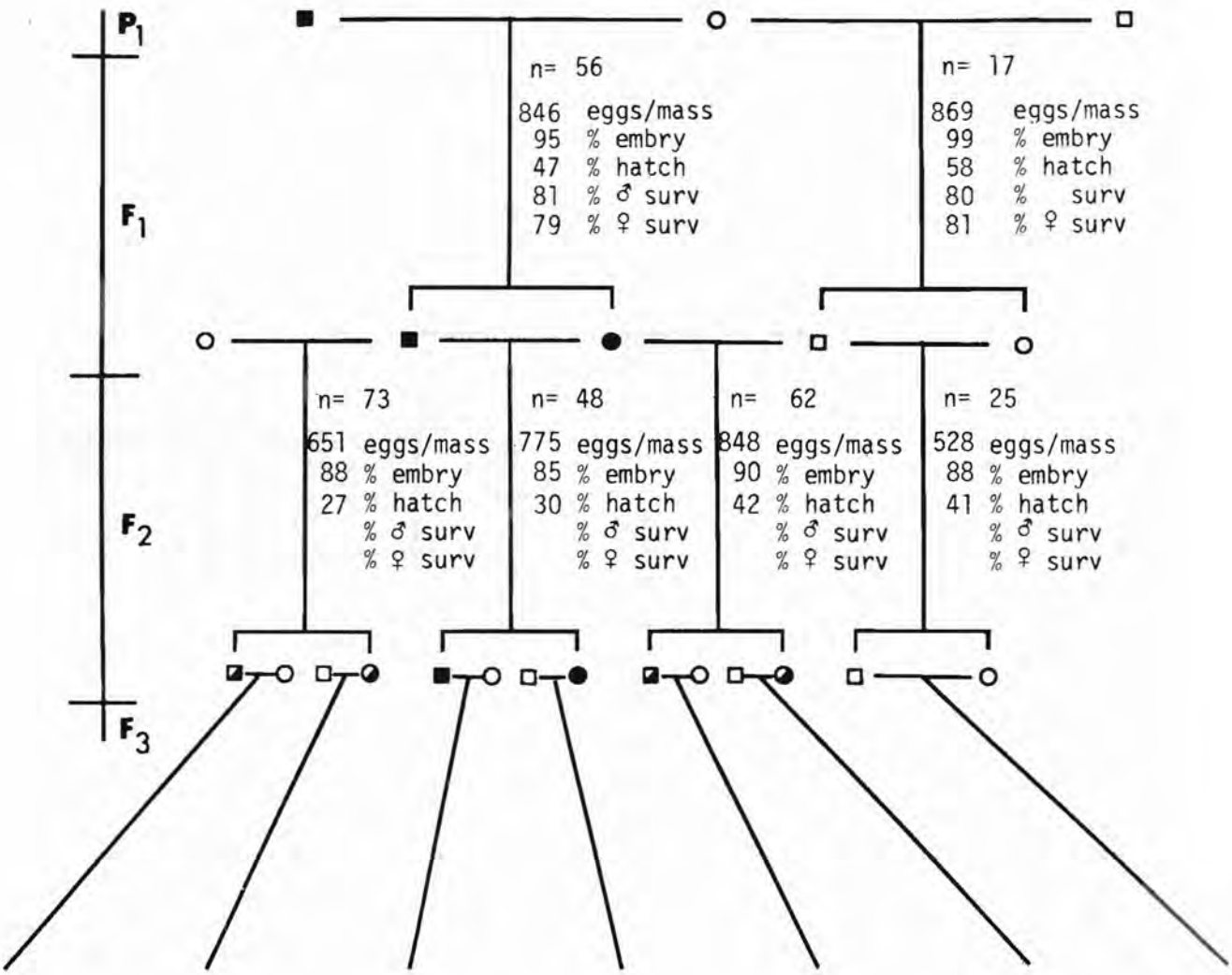
Project Number: GM 8.2.2
Project Title: Radiological Sterilization of Male Gypsy Moths
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: C. P. Schwalbe

This project has concentrated on development of the age:dosage formula for irradiation of male pupae to induce acceptable degrees of sterility. The last laboratory report summarized studies of inherited sterility in the F_1 generation. Those results indicated that in all but the 2 krad treatments, a high degree of sterility occurred in the F_1. It was noteworthy that F_2 egg masses from treated parents were consistently smaller than those from control parents. Hatch from those F_2 egg masses was always near 0. Based upon this fact, we have adjusted our sterilizing dose from 15 krad to 10 krad. It is felt that a broader age class of pupae can be treated with less somatic damage.

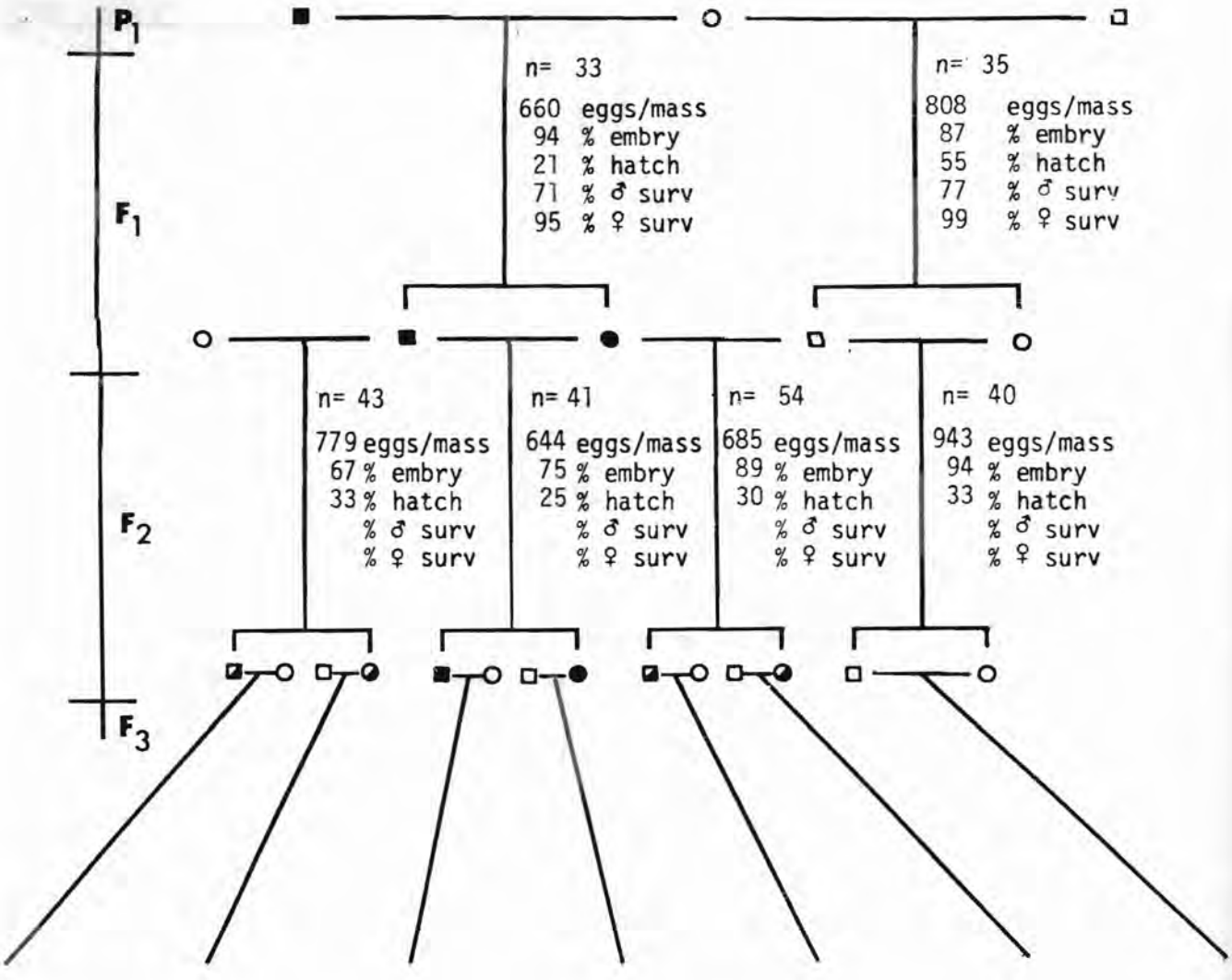
Because of the volume of material generated in studies such as this, it was decided to rear into the F_3 only those insects which were in the 8-9 day age class when irradiated in the P_1 generation. Generally, there were few F_3 egg masses available because of high sterility and low survival in the F_1 and F_2 generations. Small egg masses were observed in the F_3 from the 2 krad/8-9 day treatment. However, hatch was not suppressed. In the 8 krad/8-9 day treatment, F_1 ♀ crossed with normal ♂ showed reduced hatch in F_2, but not in F_3. The sample of F_1 ♂ x normal ♀ crosses was too low to assess in the F_3 generation. Similar results were obtained in the 10 krad and 15 krad treatments.

This phase of the project is now completed and will not be reported on further. Additional work on sterilization of adult moths and sperm transfer in the F_1 generation will follow in subsequent reports.

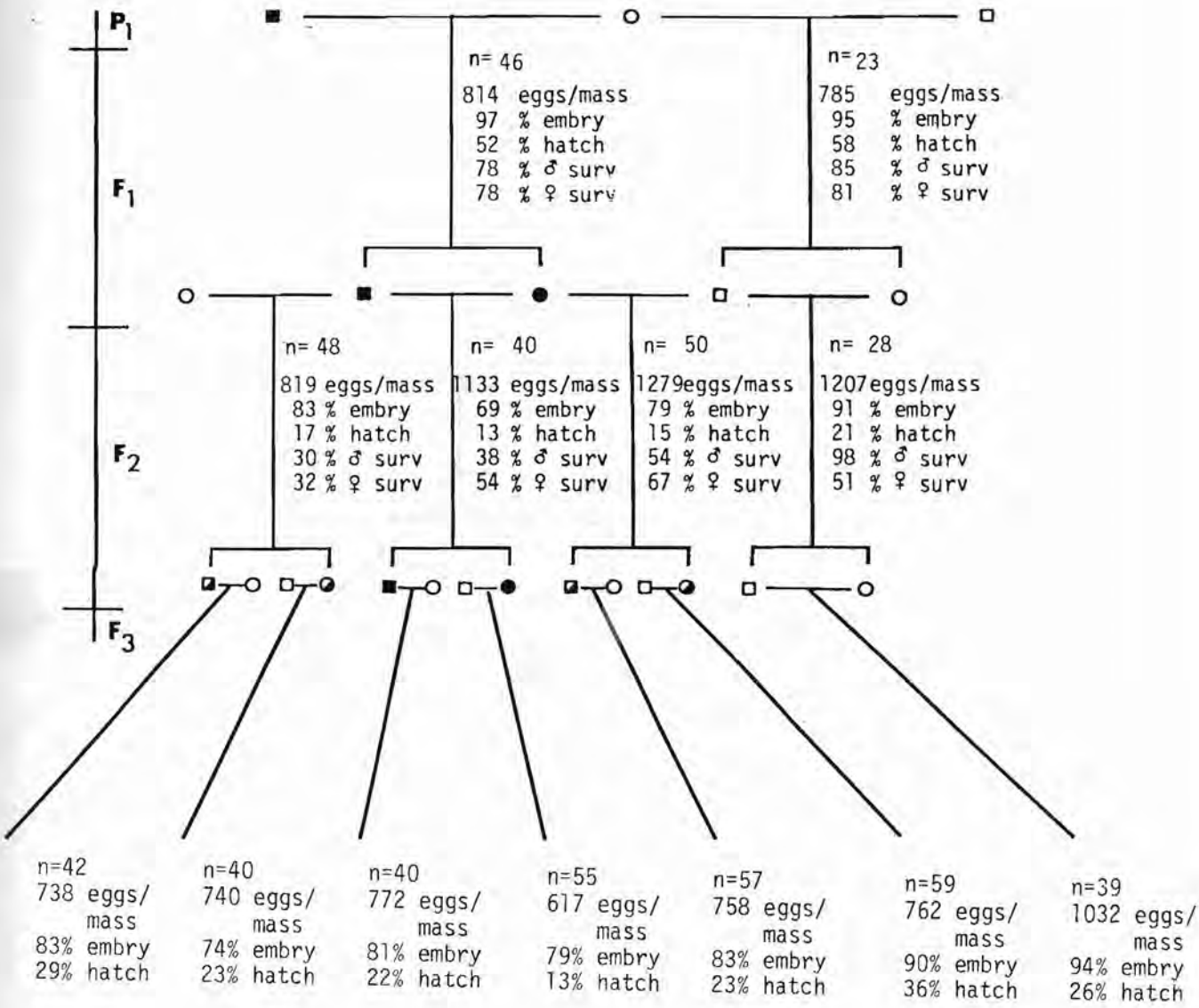
P_1 males irradiated with 2 krad at 45 days



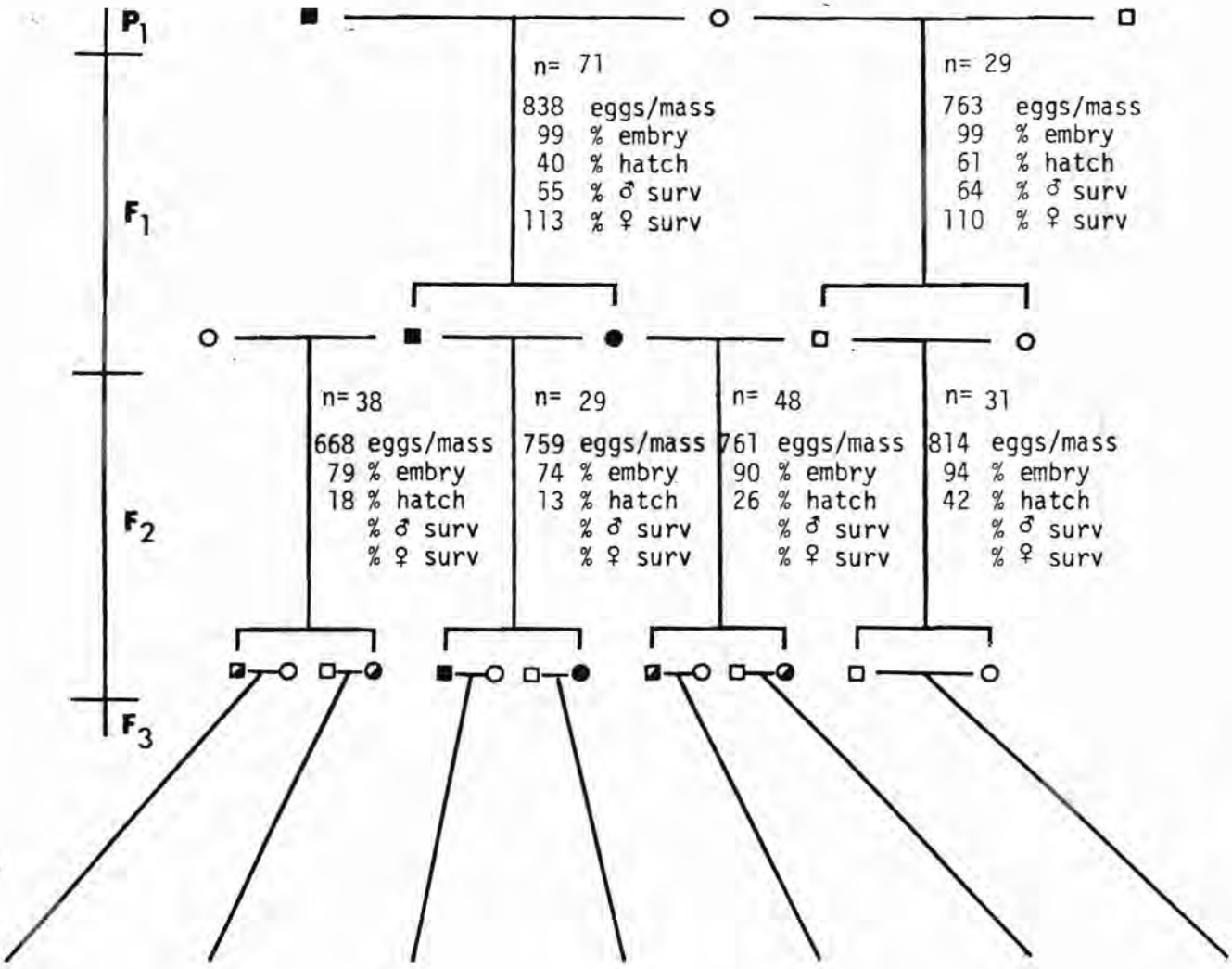
P_1 males irradiated with 2 krad at 6-7 days



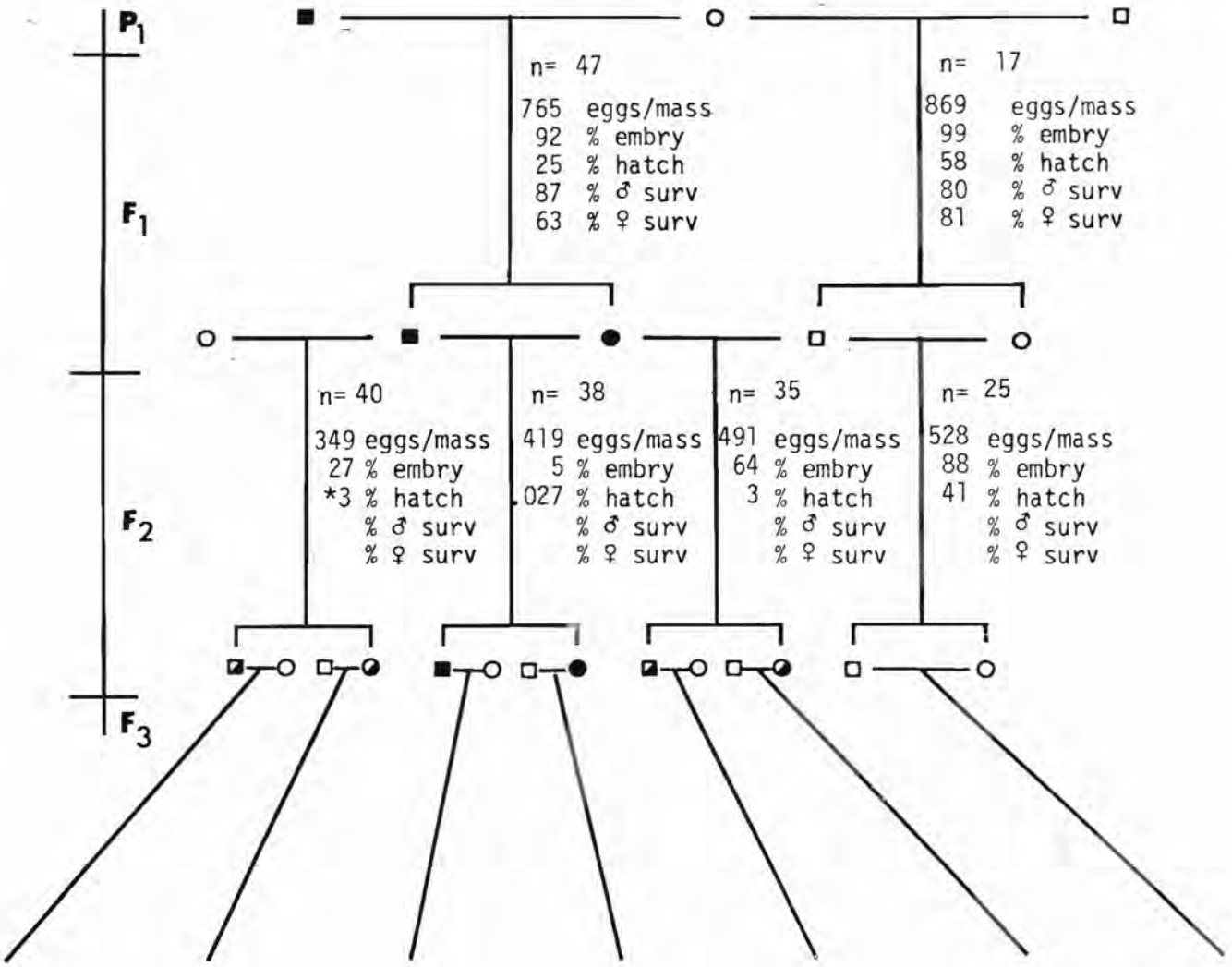
P_1 males irradiated with 2 krad at 8-9 days



P_1 males irradiated with 2 krad at 10-11 days

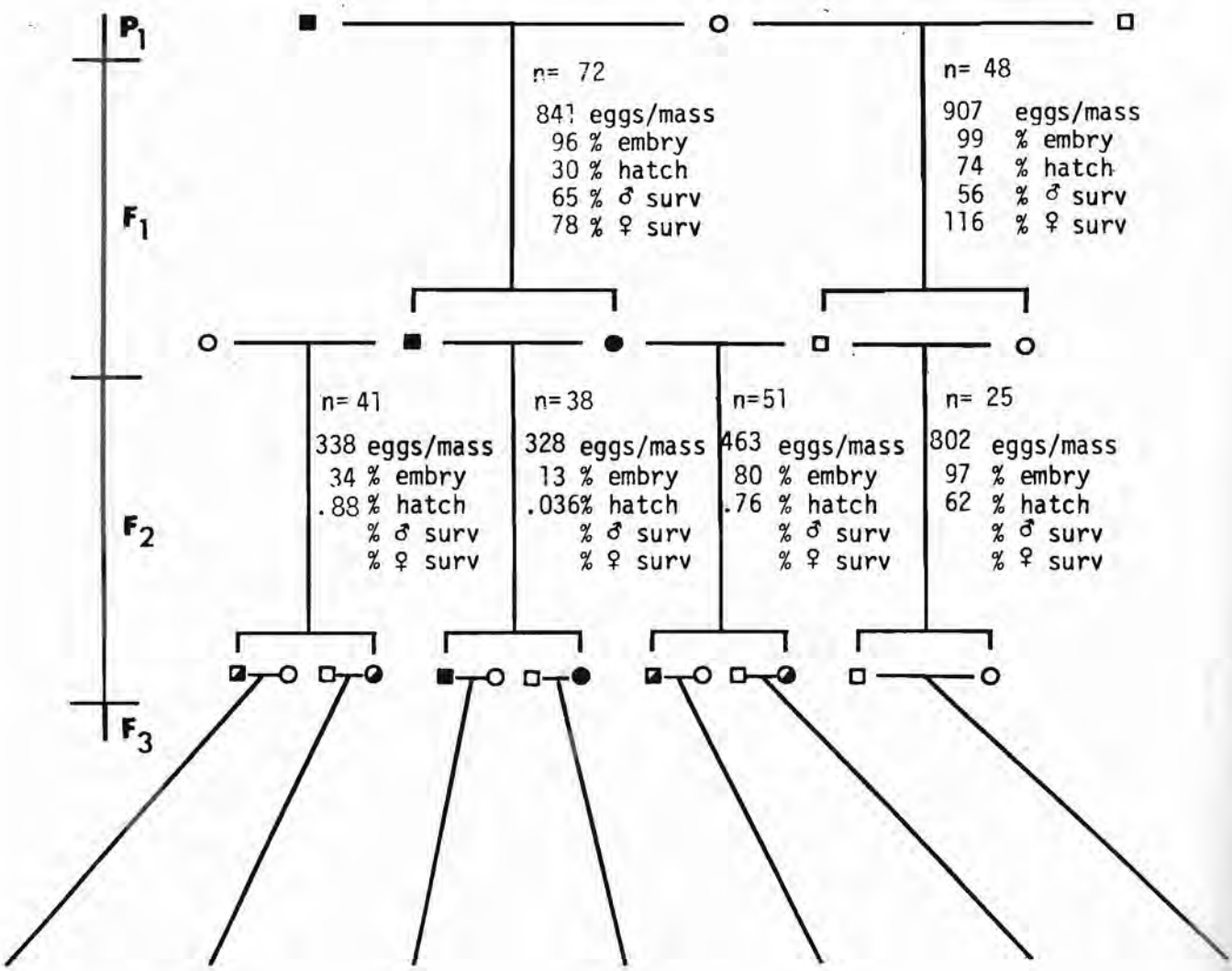


P_1 males irradiated with 8 krad at 4-5 days

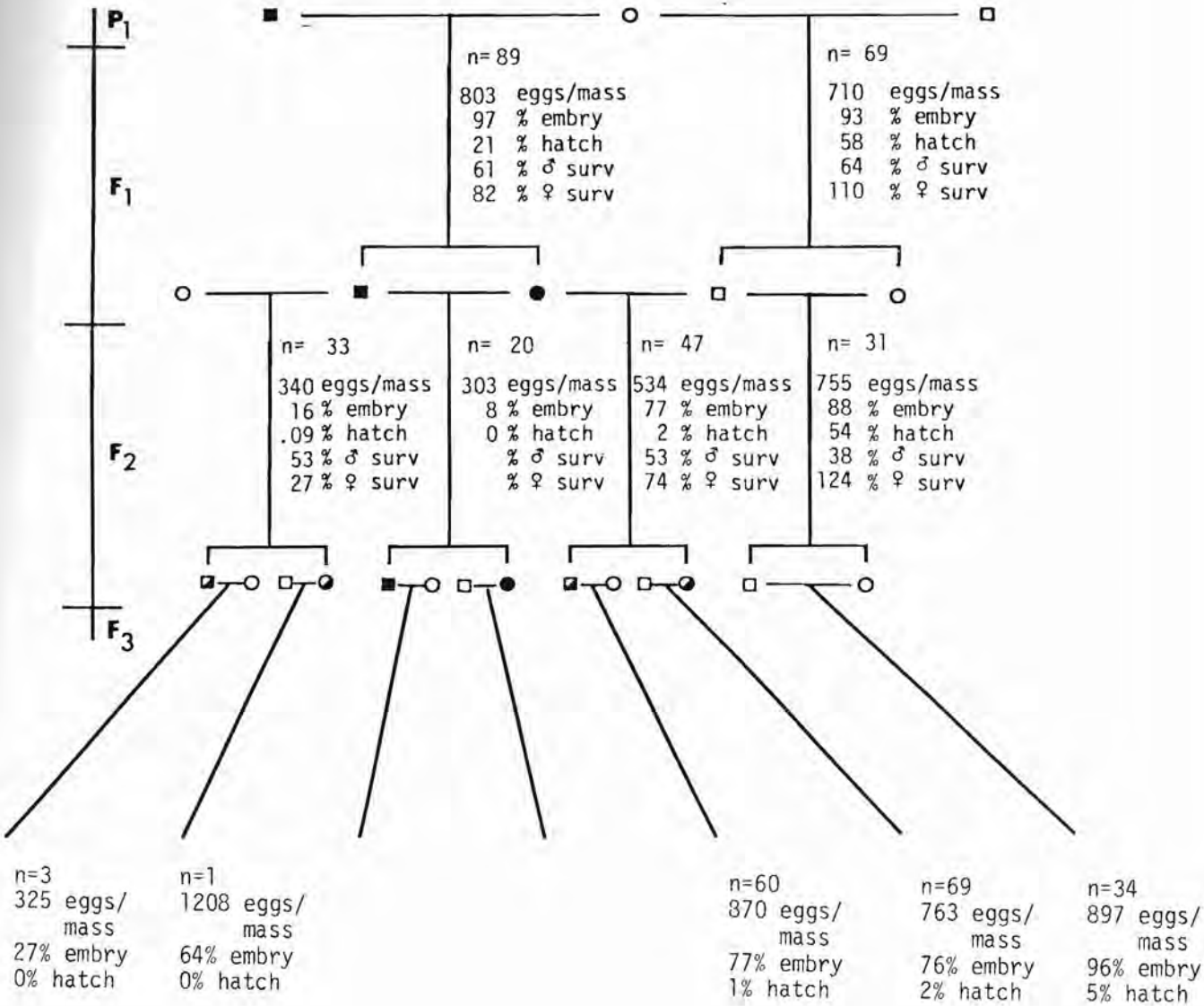


* Two egg masses of unusually large % hatch 37% and 43%

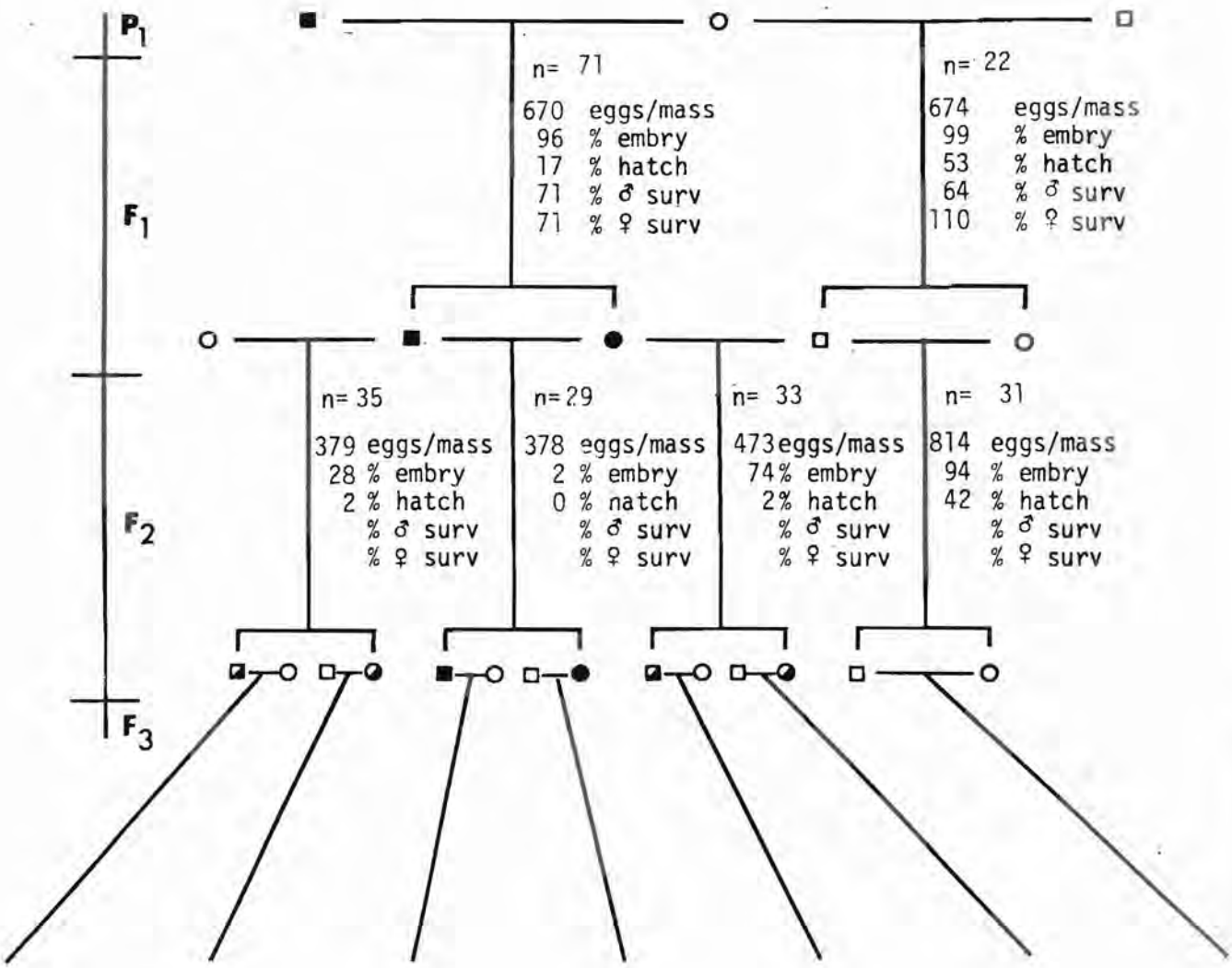
P_1 males irradiated with 8 krad at 6-7 days



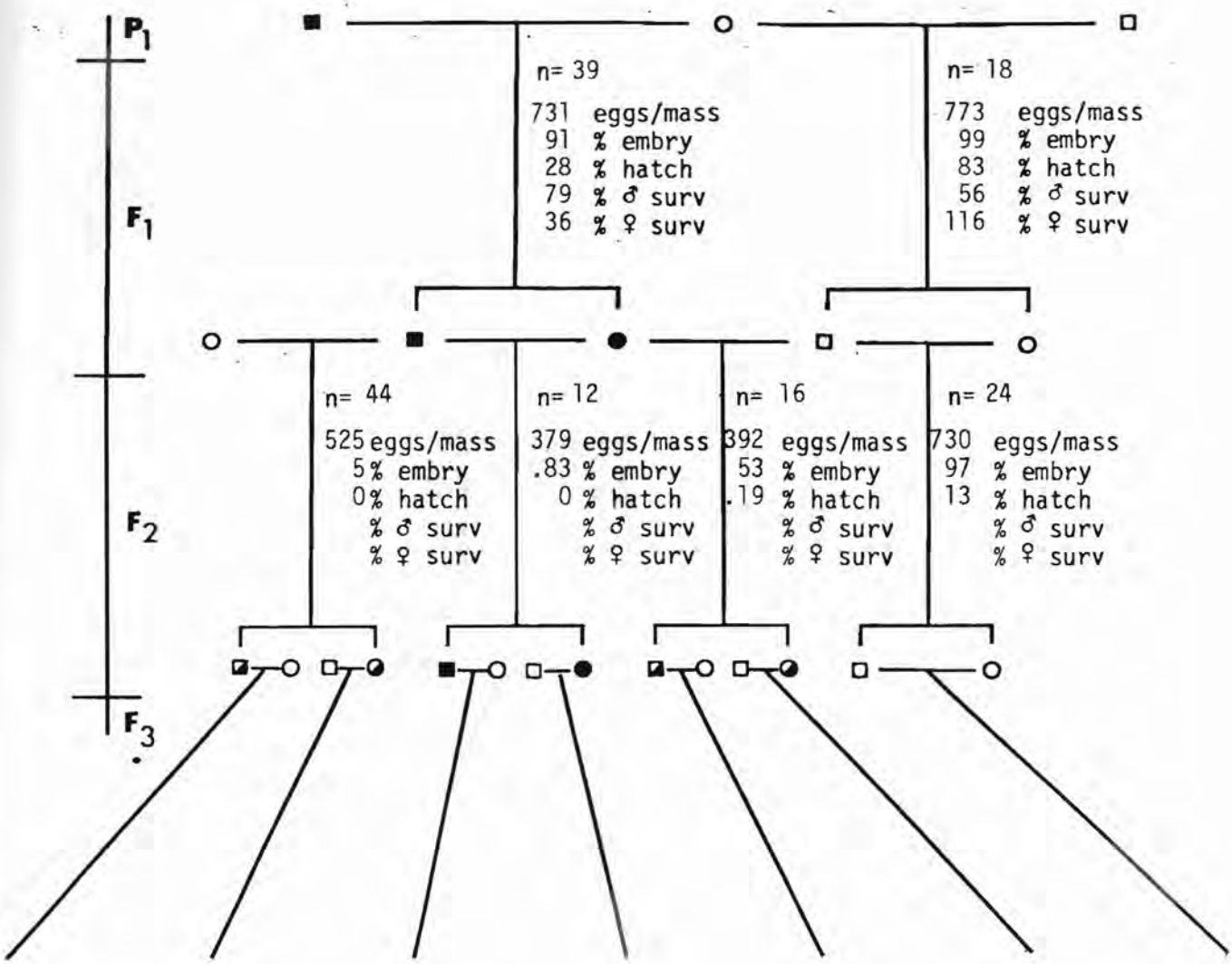
P_1 males irradiated with 8 krad at 8-9 days



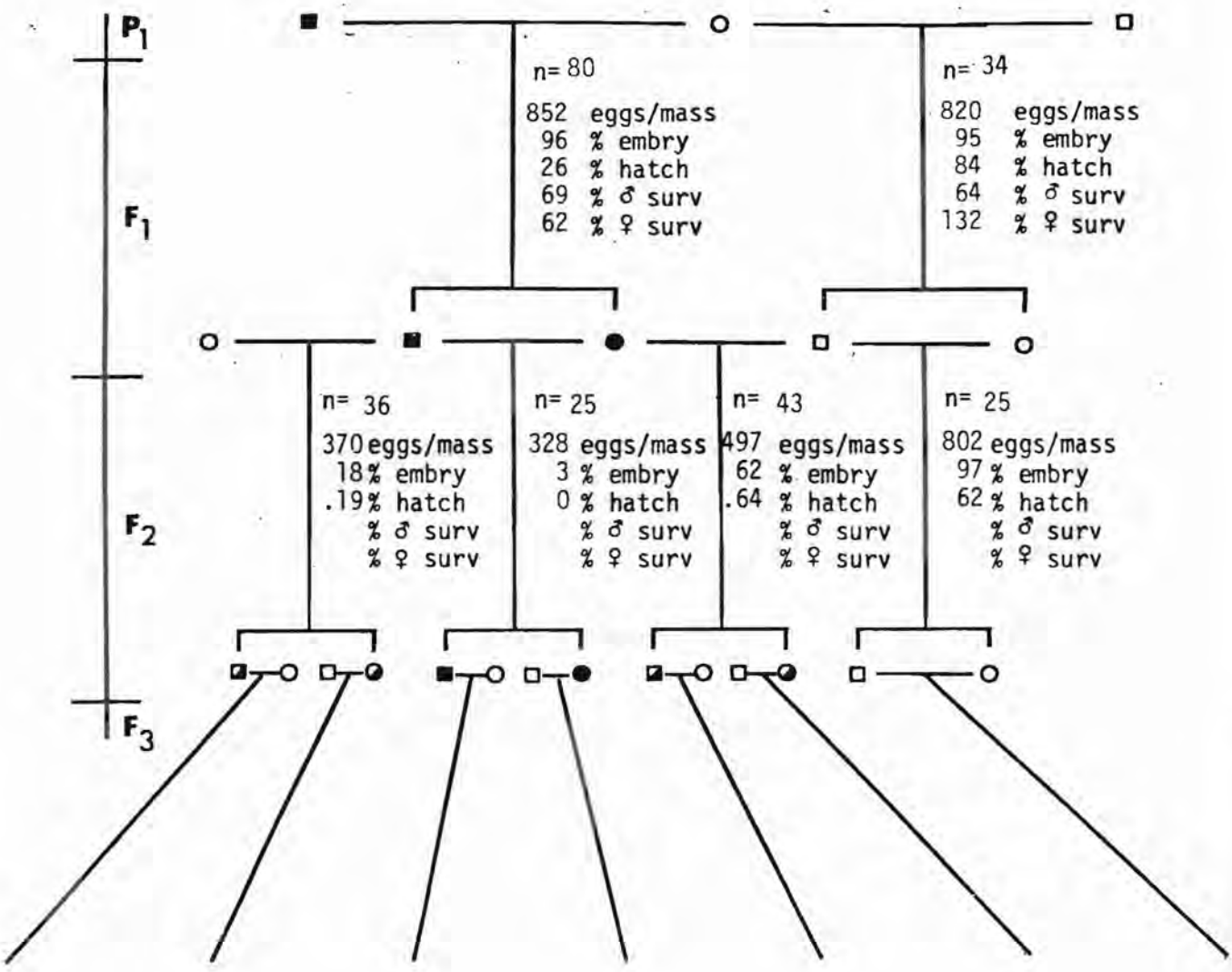
P_1 males irradiated with 8 krad at 10-11 days



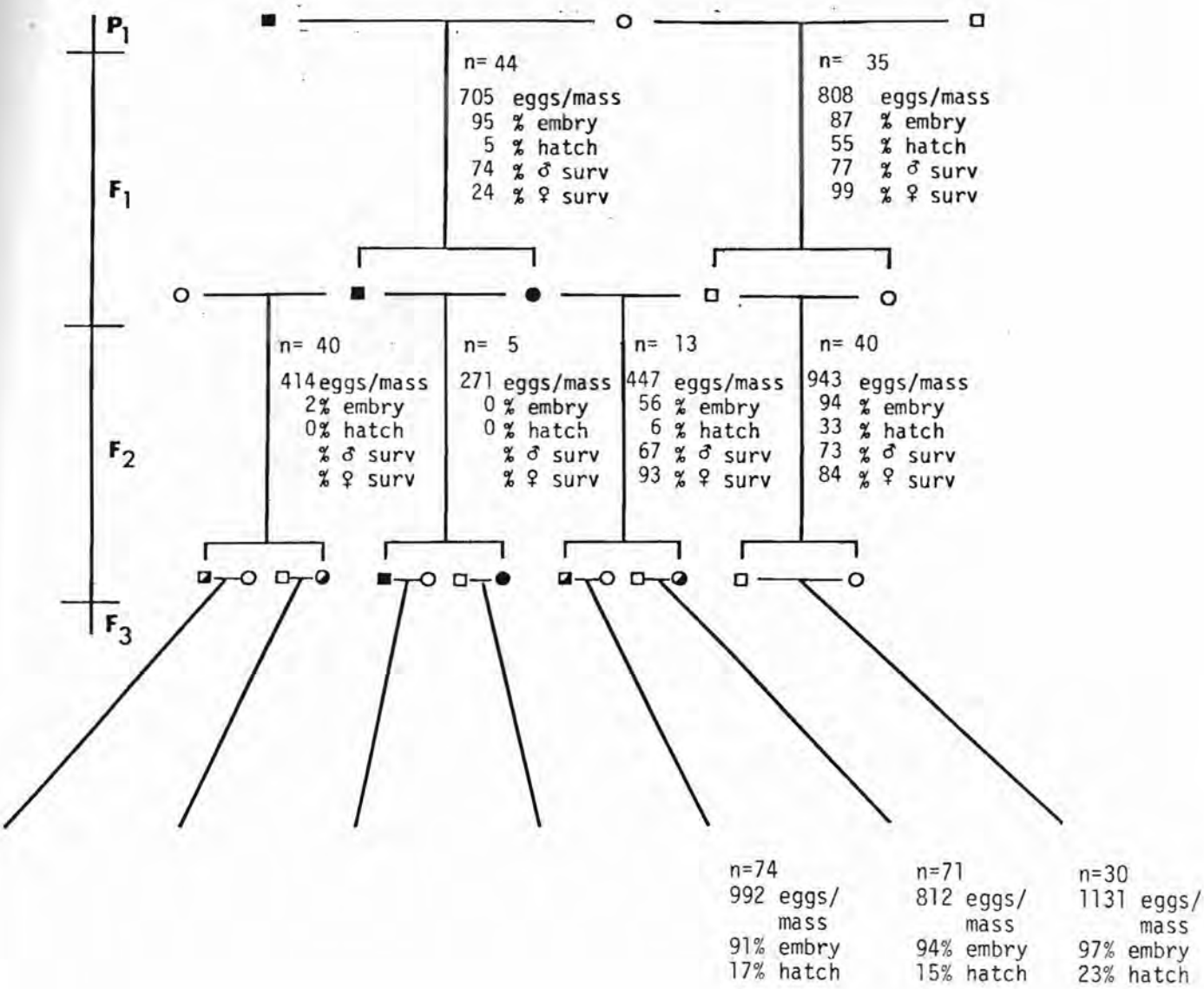
P_1 males irradiated with 10 krad at 4-5 days



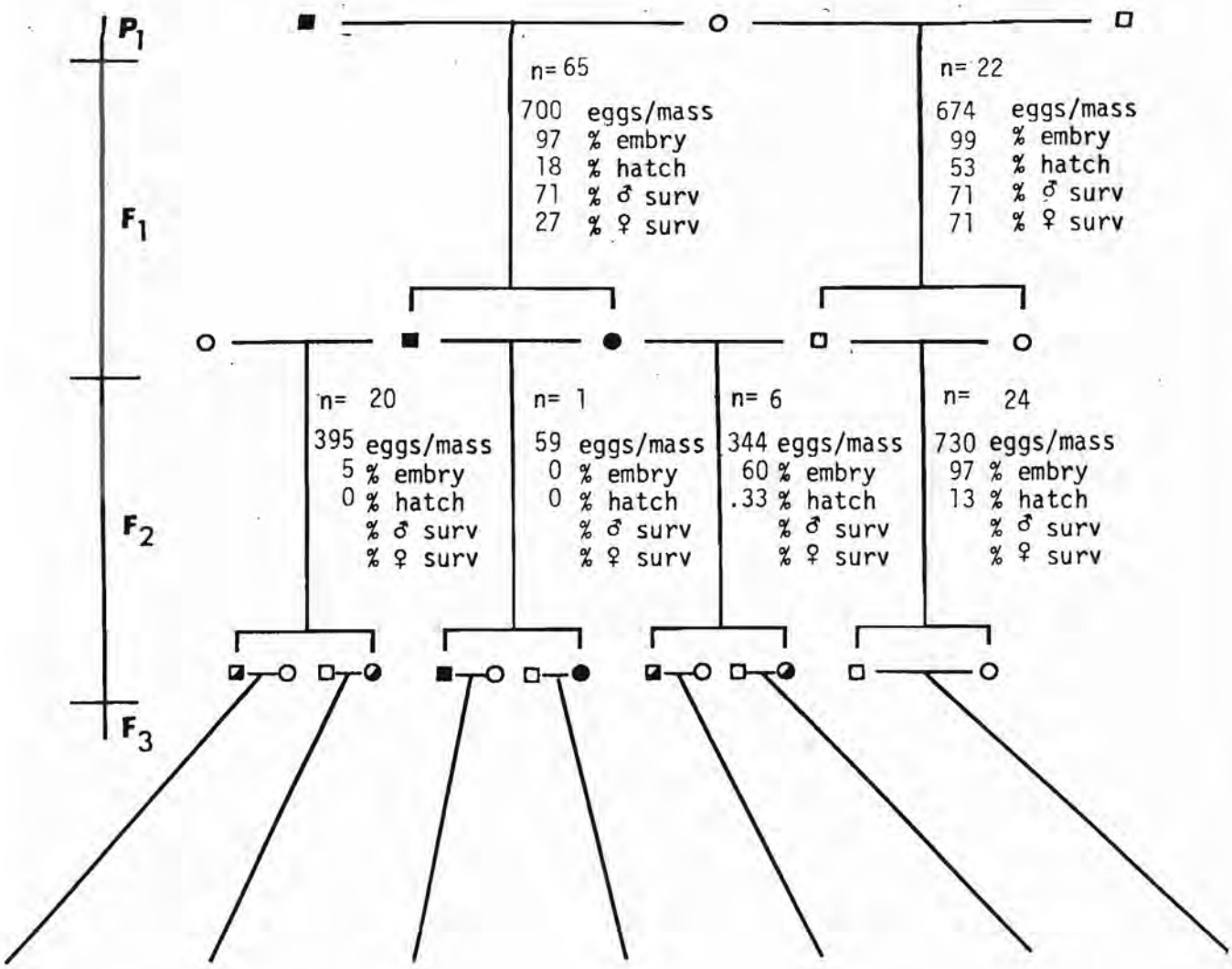
P_1 males irradiated with 10 krad at 6-7 days



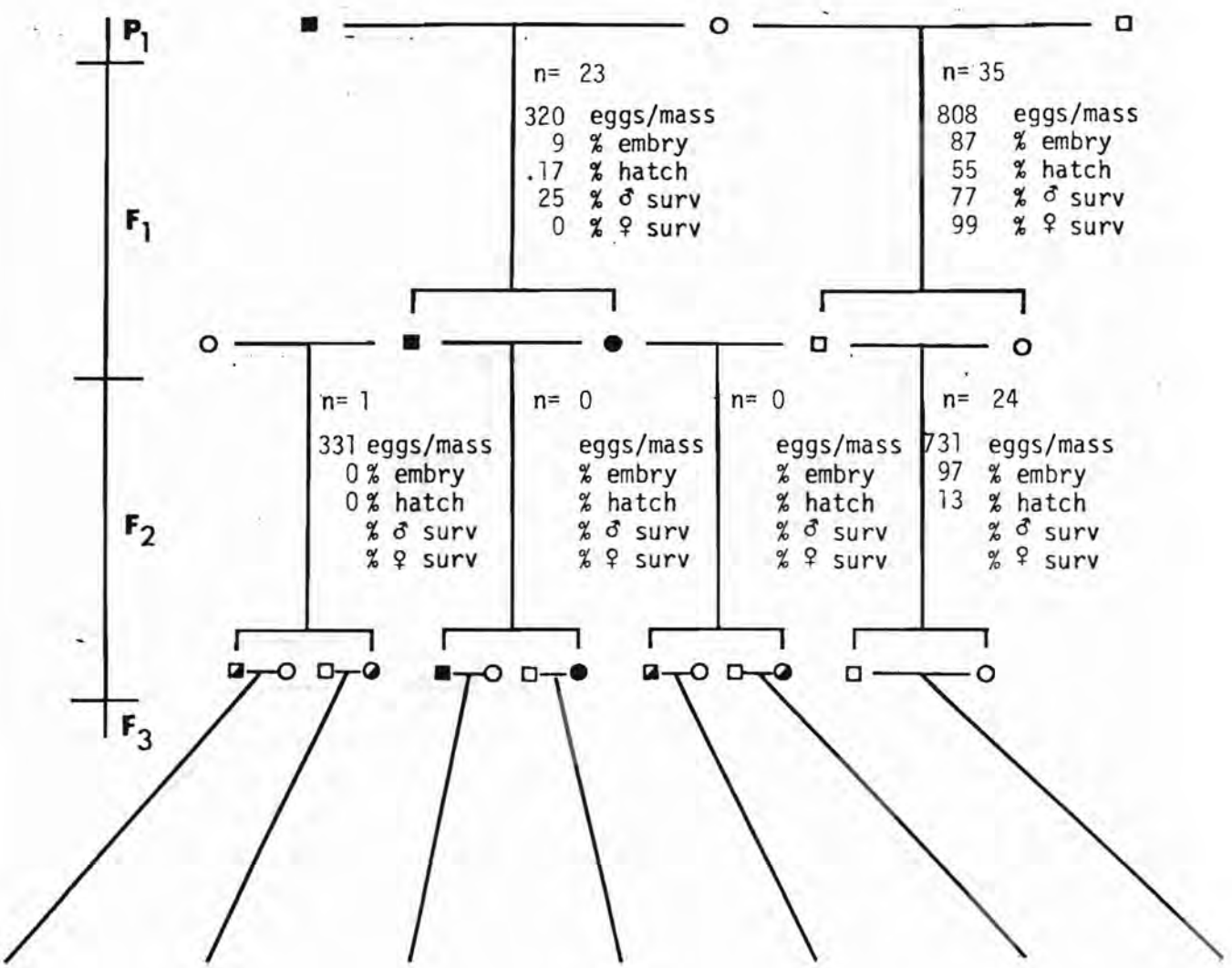
P_1 males irradiated with 10 krad at 8-9 days



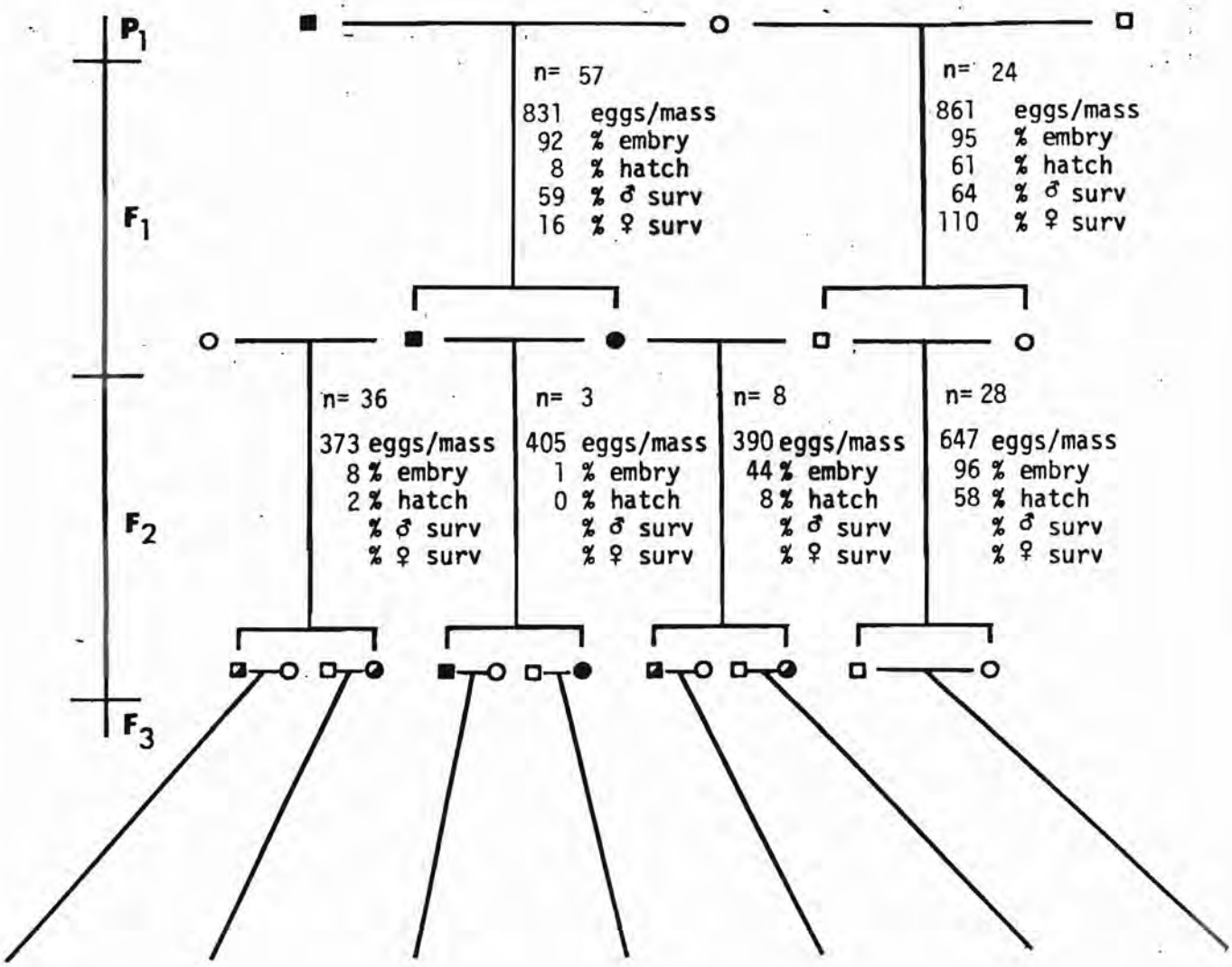
P_1 males irradiated with 10 krad at 10-11 days



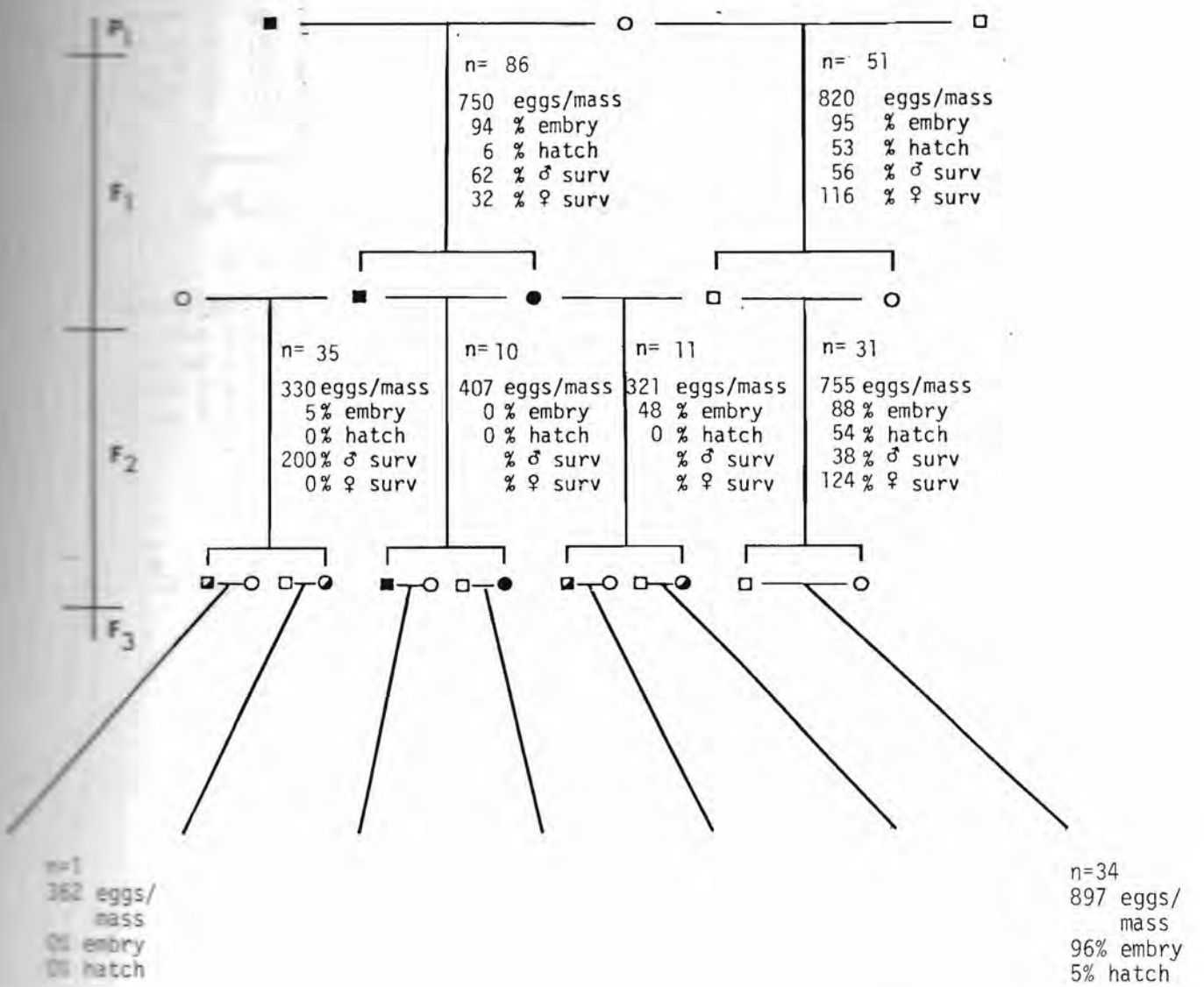
P_1 males irradiated with 15 krad at 4-5 days



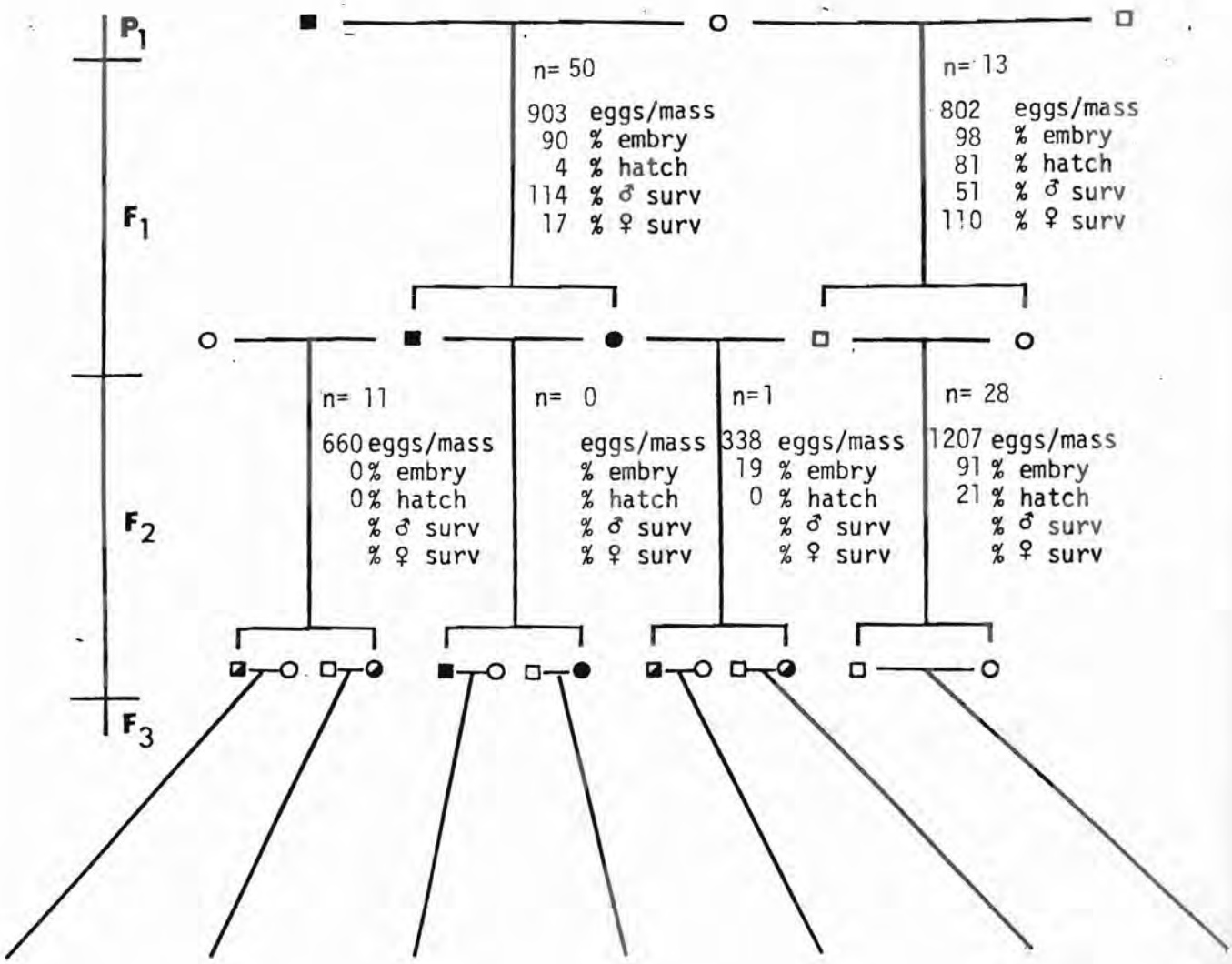
P_1 males irradiated with 15 krad at 6-7 days



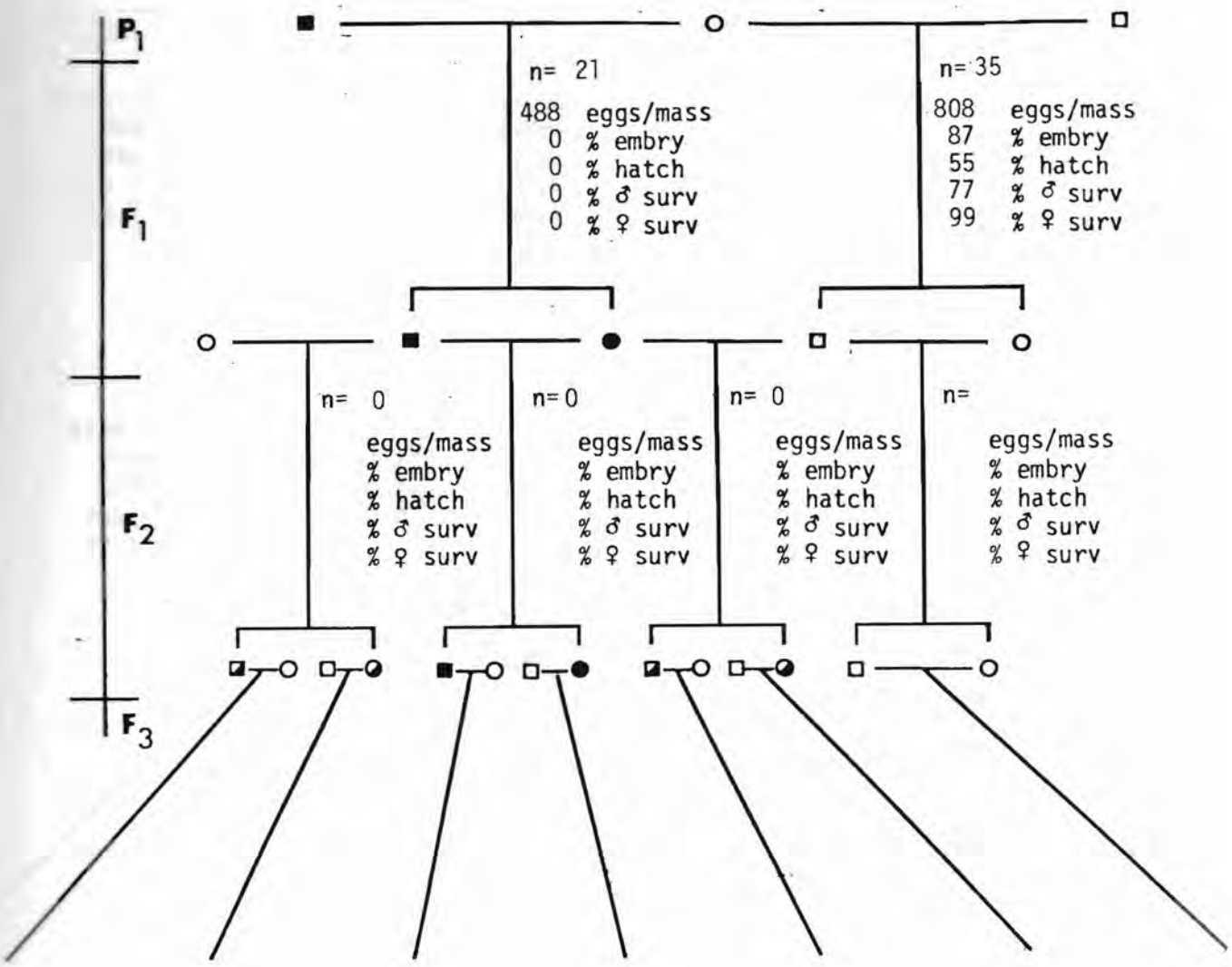
P_1 males irradiated with 15 krad at 8-9 days



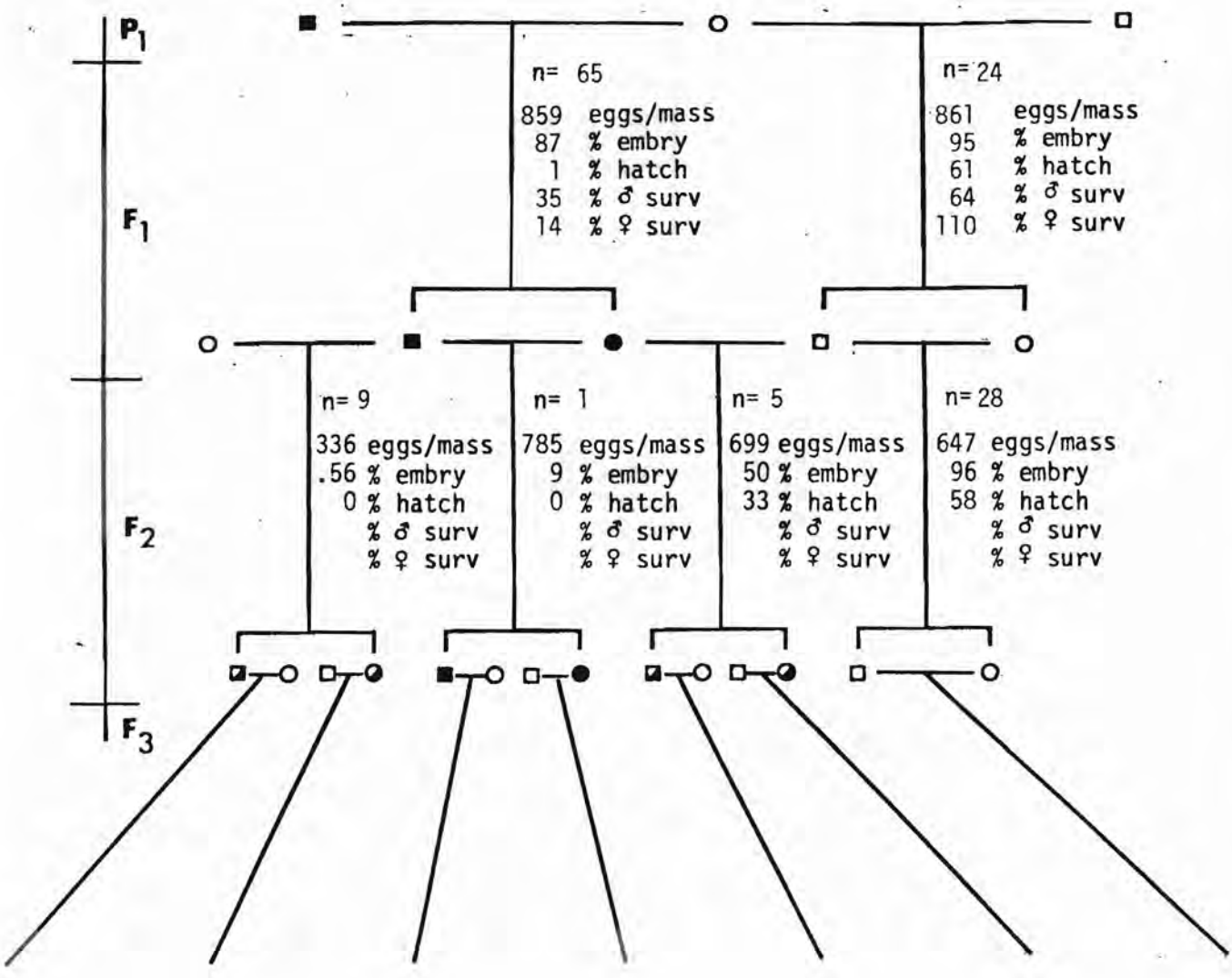
P_1 males irradiated with 15 krad at 10-11 days



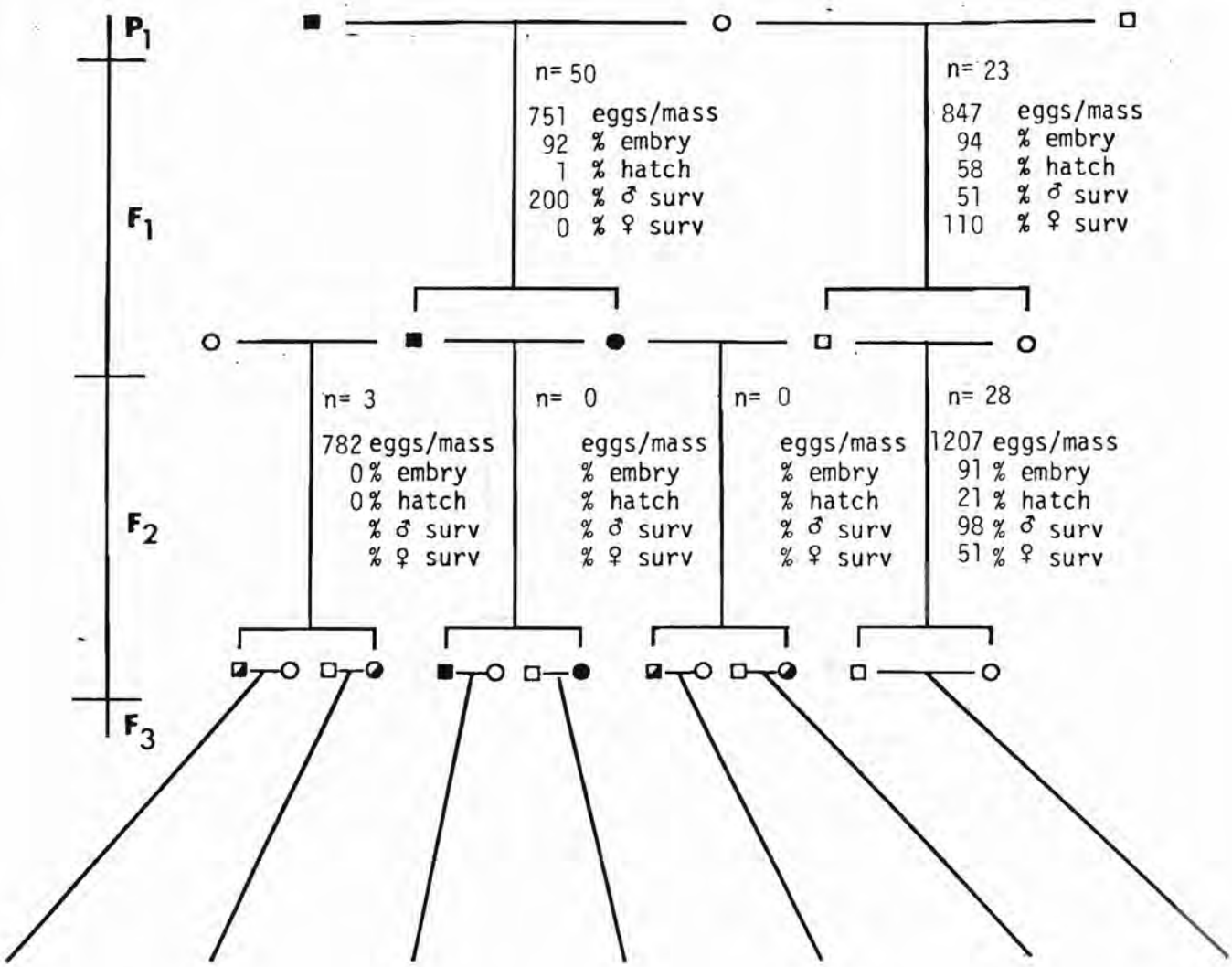
P_1 males irradiated with 20 krad at 4-5 days



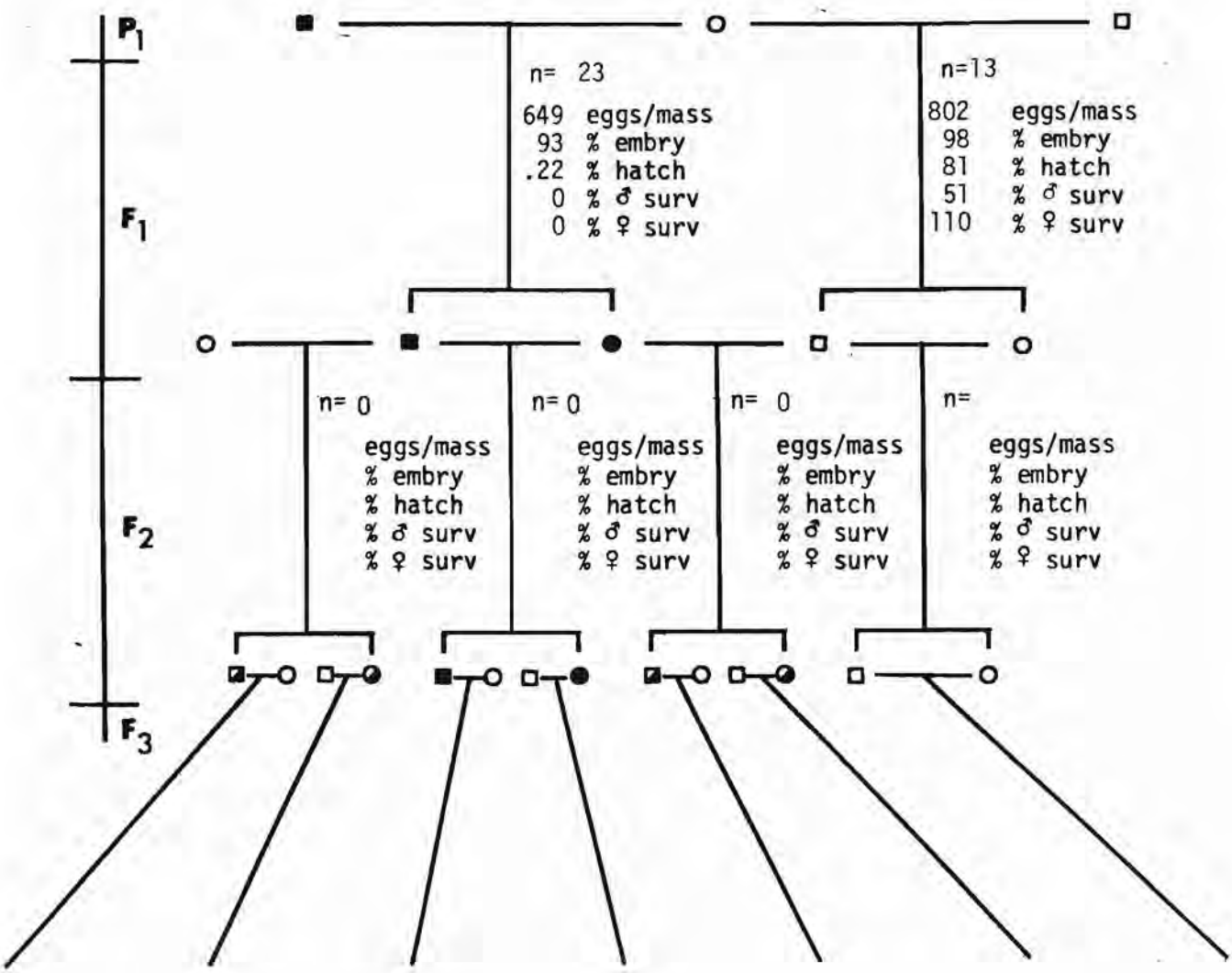
P_1 males irradiated with 20 krad at 6-7 days



P_1 males irradiated with 20 krad at 8-9 days



P_1 males irradiated with 20 krad at 10-11 days



Project Number: GM 8.2.3
Project Title: Gypsy Moth Mating Behavior
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leader: C. P. Schwalbe

This project is conducted to assess various aspects of mating behavior of sterilized male moths. In previous reports we discussed the translocation of sperm within the female as affected by duration of copulation and length of time after copulation that dissection was performed. This report contains a comparison of sterile and fertile males mating behavior in this context. Experimental details can be found in earlier reports.

Duration of Copulation (Min)	Time Dissected (Min)	Distribution of Sperm: Irradiated n	Irradiated Vulva	Irradiated Bursa	Irradiated Spermatheca	Control n	Control Vulva	Control Bursa	Control Spermatheca
5	5	10	80/70 1/	30/20	0/0	10	80/80	20/20	0/0
10	10	10	90/80	50/50	0/0	8	88/88	63/50	38/38
10	60	6	83/83	83/83	83/83	8	88/88	88/75	88/88
10	120	8	100/100	88/100	88/88	7	86/100	100/100	100/100
Uninterrupted	60	9	100/100	89/89	89/89	9	89/89	78/89	78/78
"	120	10	100/100	90/90	90/90	9	100/100	100/100	100/100

1/ Values represent % of females which contained apyrene and eupyrene sperm cells (e.g. 80% contained apyrene, 70% contained eupyrene)

Results indicate that translocation of apyrene and eupyrene sperm within females is similar regardless of whether the male is fertile or sterilized. Additional studies will be conducted with F_1 progeny of substerilized males.

Another experiment was conducted to evaluate the propensity for multiple-mating by sterile males. A sequence of mating pairs was set up and observed. After copulation was completed, males were presented with other virgin females. Those that mated a second time were offered additional females. Time to begin mating, duration of copulation, % embryonation and egg mass size were recorded. Results follow:

	n	Time to Begin Copulation	Duration of Copulation	% Embry.	Eggs/ mass
		Control			
1st mating	58	216	57	86	550
2nd mating	12	106	50	82	491
3rd mating	1	91	44	95	200
		Irradiated			
1st mating	42	206	51	64	520
2nd mating	7	172	43	66	588
3rd mating	2	14	57	83	535

It appears that the occurrence of multiple mating by fertile and sterile males is similar. Precopulatory period was shorter with each successive mating, but this may have been a result of experimental design. Before conclusions can be drawn, a more comprehensive test will be required.

Project Number: GM 8.2.6
Project Title: Large Capacity Milk Carton Traps - Design Improvements
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: E. C. Paszek, C. P Schwalbe

A series of tests were conducted during the summer of 1979 to determine effects of various large capacity trap design changes on trap effectiveness. Those studies are discussed individually in this report.

An initial experiment was a comparison of six 2 qt. MC traps with the following number of 5/16" x 1" entrance ports: 16, 12, 8, 4, 12 (with the top 4 entrance ports enlarged to 1/2 x 1") and 12 (triangular shaped entrance ports, 1-1/4 x 7/8 x 7/8"). Twenty four replicates of each design were baited with 500 μg (+) Hercon wick; a 3 g (18.6%) DDVP flea tag was used as the killing agent. Traps were set out 60' apart in a random pattern in a 24 x 6 grid in a heavily infested pine-oak forest. The traps were in the field July 2-29 after which they were removed and the moths counted. Results are summarized in the table below.

	Trap Type					
	MC 16	MC 12	MC 8	MC 4	MC 12 Modified	MC 12 Triangular
Total captured	7,730	11,323	12,703	11,063	8,155	2,353
Av. No. moths/trap	322 b	472 a	529 a	461 a	340 b	98 c
Rank	5	2	1	3	4	6

Means not followed by same letter are significantly different (Duncan's .05).

The MC traps with 12, 8 and 4 entrance ports captured significantly more males than other designs. Evidently the MC 12 Modified and MC 12 Triangular entry ports were large enough to increase the incidence of escape. Escape from MC 16 traps may have been affected by the larger number of entry ports.

Another test was conducted in which traps of various sizes and numbers of entrance ports were compared. Ten replicates of each design were placed approximately 200' apart in a moderate infestation in Dighton Rock State Park in Berkley, MA. Traps were baited with the 1979 500 μg (+) Hercon wick; a 3 g DDVP flea tag was used as the killing agent. Traps were in the field for 8 weeks from June 28 - August 27, 1979. They were checked 5 times; at each examination the moths were counted and removed. Test design and results are summarized below:

Trap Size	No. Entrance Ports	Entrance port Dimensions	Avg. No. moths Captured/trap
1 gal.	12	7/16 x 1"	306 b
2 qt. (std)	12	5/16 x 1"	442 a
1 qt.	12	7/16 x 1"	89 c
1 qt.	8	7/16 x 1"	150 c
1 pt.	4	7/16 x 1"	143 c

Means not followed by same letter are significantly different (Duncan's .05).

These results are difficult to evaluate because of the confusion of entry port dimensions in the trap designs. We feel that the smaller 5/16 x 1" ports are more effective in that the escape incidence is lower. However, this has not been specifically tested. A number of factors impact on the efficienty of traps: ease of entry, ease of escape and time for escape. DDVP concentrations will be higher in small traps, thus allowing less time for knockdown. Escape incidence may be related to some undefined "trap size/no. entry port" relationship. Defining this will require further study. From this test, few conclusions regarding trap performance can be drawn.

In a similar study, trap size and number of entrance ports were compared in a sparsely infested watershed of the Fall River Reservoir. Traps were baited with 500 μg of the 1979 (+) Hercon wicks and were in the field from June 22 - August 15, 1979. A 3 g, flea tag, Vaporette (DDVP) manufactured by Zoecon Industries, Inc. was used as a killing agent inside the MC traps. Six replicates of each design were randomly placed in a 6 x 7 grid with intersects 574' apart. Traps were checked four times and Delta traps were replaced if more than 10 moths were captured. Test design and results are summarized below.

Trap size	No. entrance ports	Entrance port dimensions	Avg. no. moths captured/trap
1 gal.	12	7/16 x 1"	53 b
2 qt. (std)	12	5/16 x 1"	97 a
1 qt.	12	7/16 x 1"	32 bc
1 qt.	8	"	39 bc
1 pt.	8	"	34 bc
1 pt.	4	"	37 bc
Delta	2	-	18 c

Means not followed by same letter are significantly different (Duncan's .05).

Results of this test were similar to those preceding, particularly with the greatest capture efficiency in the 2 qt. standard design. However, all 1 qt. and 1 pt. traps captured similar numbers of moths, irrespective of the number of entry ports. It is hypothesized that escape from the 1 gal. traps was high because of inadequate concentrations of DDVP. Definitive studies to assess reasons for greatest capture in 2 qt. standard traps remain to be conducted.

The following study was conducted August 8 - 16, 1979 in an oak pine forest where adult flight had ceased. Trap designs tested were 2 qt. (MC) with 4, 8 or 12 entry ports (1, 2 or 3 per side). Entry ports were 5/16 x 1". Delta traps were included for comparison. Twenty replicates of each design were baited with 500 µg 1979 (+) Hercon dispensers and randomly placed 100' apart on a 20 x 4 grid. Newly emerged laboratory-reared moths were placed into pint containers, (50/container) and aged for 24 hours. They were transported into the field in cooled carriers and released uniformly throughout the plot at release points equidistant between the trap lines. Three releases were made on August 8, 10 and 14. Traps were checked 24 hours after each release; moths counted and removed from MC traps and the Delta traps were replaced with new traps. Results are summarized below.

Release No.	No. Released	Total captured (20 replicates) Trap type				Percent Recovered
		MC 12	MC 8	MC 4	Delta	
1	2500	339	299	211	212	42
2	3500	375	443	254	261	38
3	1800	139	138	127	100	28
Total	7800	853 a	880 a	592 b	573 b	37
Rank		2	1	3	4	

Means not followed by same letter are significantly different (P=0.5).

Results again indicate that the number of entry ports influences the effectiveness of traps in capturing male moths. Fewer males were captured in MC 4 and Delta traps than in MC 8 and MC 12. We theorize that while the incidence of males entering traps increases as entry port number increases, the incidence of escape also increases and thus a point of diminishing returns is reached.

It is also of interest to note that in nearly all cases the Delta traps captured fewer males than the other designs tested. This may warrant further study to evaluate other trap designs for replacing Delta traps in detection surveys.

Another small test was conducted to compare capture of males in MC and Delta traps baited with 1979 (+) Hercon dispensers. Ten traps of each type were placed 60' apart in a moderate infestation from July 17-25. They were checked 5 times during this period. MC (+), MC (±) and Delta (±) captured as average of 455, 26 and 15 during the 8-day bioassay, clearly indicating (+) to be a more effective attractant than (±). It also appears that MC traps baited with the racemic mixture captured more males than did similarly baited Delta traps although this difference was not statistically significant (t-test).

Finally, a bioassay was conducted to evaluate the following sources of (+) disparlure: 1979 (+) disparlure Hercon wicks containing 500 μg of a mixture of 1978 Farnum, 1979 Farnum and 1978 recovered; 1978 Farnum; 1979 Farnum; and 1978 recovered from used wicks and scraps remaining from preparation of wicks by Hercon. Pheromone was applied to cotton wicks in 2 qt. MC traps which were placed 60' apart in the field in a moderate infestation in Berkley, MA from July 24-August 8. There were 10 traps checked 3 times and results are summarized below.

	500 μg	100 μg	10 μg
1979 (+) Hercon	237	-	-
1979 Farnum	-	154	73
1978 Farnum	-	120	68
1978 Recovered	-	110	57

Data indicate that 1979 Farnum was more potent than 1978 Farnum and the material recovered from various sources of "used" (+) attracted fewer males than pure material. However, the 1979 (+) Hercon dispensers containing 500 μg (+) attracted the most male moths.

Project Number: GM 9.2.1
Project Title: Effects of Cold Treatment on Male Competitiveness
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: V. C. Mastro, T. M. ODell

Cold treatment of adult males will be necessary when considering the use of an adult release strategy for SMT. Males must be cooled at harvesting, for irradiation and for shipment to a release site. Cooling may be necessary for extended periods when insects are shipped long distances. The purpose of the studies described below was to evaluate the effects of chilling and other handling techniques necessary for shipment on male field competitiveness.

In these tests a circular plot design (i.e. center release point surrounded by monitoring stations) was used to compare field competitiveness of males subjected to various lengths of chilling and to different packaging techniques. In the first comparison the following treatment groups were evaluated:

Treatment group:

1) Males harvested as all-aged pupae held and eclosed in the laboratory (16:8 - L:D, 26.7°C, hereafter referred to as "SLC"), chilled (9°C) irradiated and released on day of eclosion.

2) Males harvested as all-aged pupae held and eclosed in the laboratory (SLC), chilled (9°C) 24 hours, irradiated (15 krads) and released the day after eclosion.

3) Males harvested as all-aged pupae held and eclosed in the laboratory (SLC), chilled (9°C) 48 hours, irradiated (15 krads) and released 2 days after eclosion.

4) Males harvested as all-aged pupae held and eclosed in the field.

Male treatment groups were released in the following manner to compensate for age differences. Treatment groups 1 and 4 were released on 7/2, groups 2 and 3 were released on 7/3/79. Therefore, males from group 3 were 24 hours older than the other treatment groups on 7/3/79. All treatments were released on 2 plots simultaneously. To monitor male activity, 2 concentric circles (70 m and 140 m radius) of (+) disparlure baited (Hercon wicks) modified-delta traps were placed around the plot centers.

Results of this test do not indicate that irradiation or chilling had any adverse effects on the ability of males to fly or to respond to pheromone-baited traps. Interestingly, males that had been chilled for 48 hours (treatment 3) were recaptured in significantly greater proportions than the other 3 treatment groups.

Table 1. Comparison of male chilling and irradiation treatments.

Treatment	Proportion of Released Males Recovered		
	Replicate 1	Replicate 2	$\bar{x}$
1	20.3	22.3	21.3 b 1/
2	24.0	28.0	26.0 b
3	43.0	47.8	45.4 a
4	31.1	21.5	26.3 b

1/ Vertically, mean proportions followed by the same letter are not significantly different (5% level) according to Duncan's Multiple Range Test.

Periodicity of capture for all treatments, except treatment 2 was atypical of normal male activity, (Figures 1 and 2). Males chilled for ca. 24 hours after irradiation and then released in the field displayed a normal activity periodicity with peak capture occurring at 1200 hours. Most activity for the other three male treatment groups, however, did not begin until after 1400 hours. Why this anomaly occurred is unresolved. A possible explanation for shifts in male field activity is temperature regulation of rhythms. However, temperature records for 7/3 show that by 1100 hours the temperature was 79°F and by 1200 hours it was 80°F. In previous studies, this type of temperature pattern resulted in earlier peak activity than that displayed by the control (treatment 4). Simply put, the control was not behaving as expected. Perhaps preconditioning of pupae through photoperiod or thermoperiod cues may have resulted in this effect, but these theories will need to be resolved in future studies.

The peak capture in the morning noted for treatment 4 is misleading (Figures 1 and 2). This capture occurred after traps were placed out late the previous day. Also, the last capture point on Figures 1 and 2 for all treatments was an accumulation of all activity that occurred after 1600 hours till early the next morning before male flight had begun.

Figure 1. Competition Plot (Otis) July 3, 1979

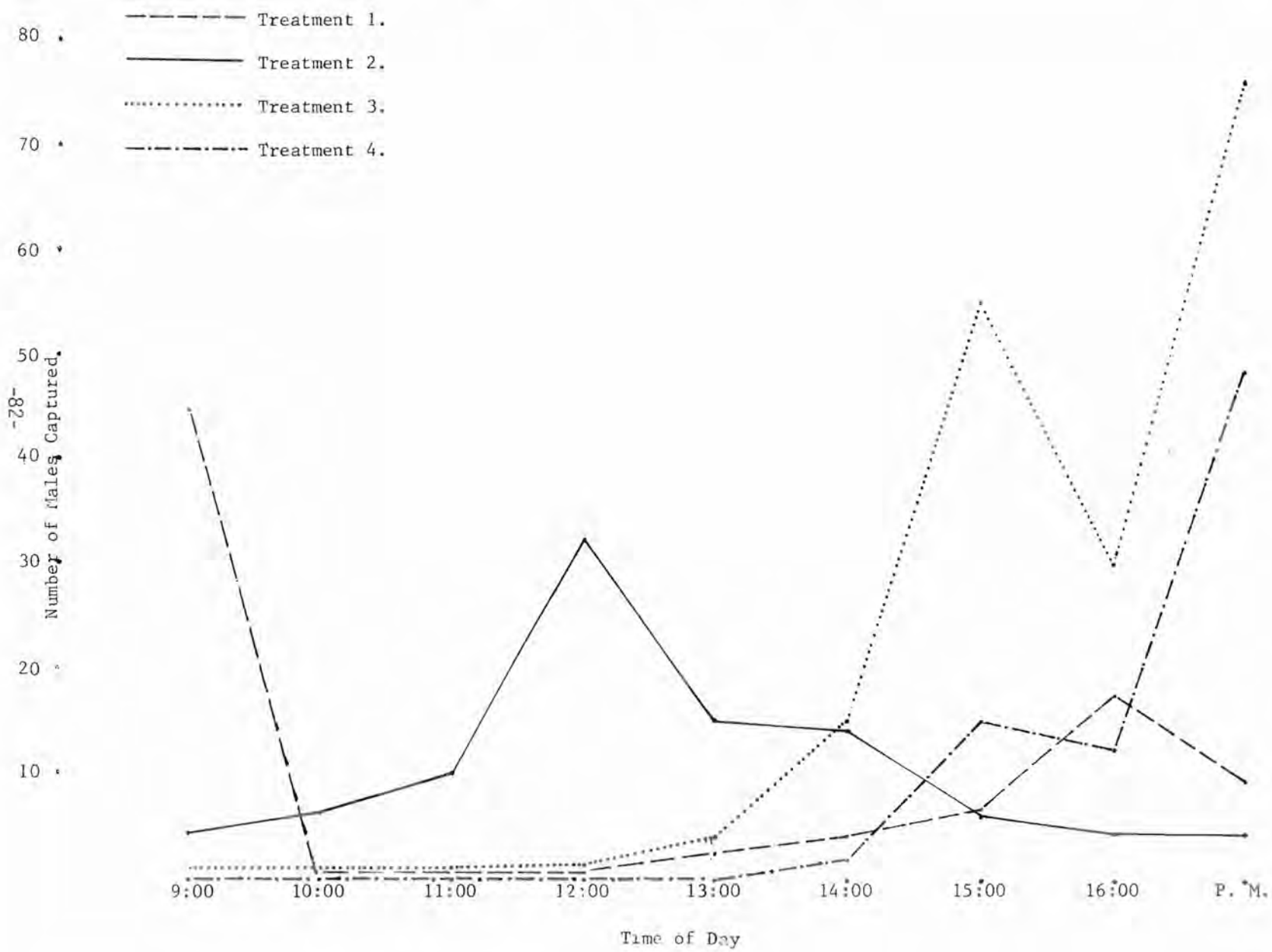
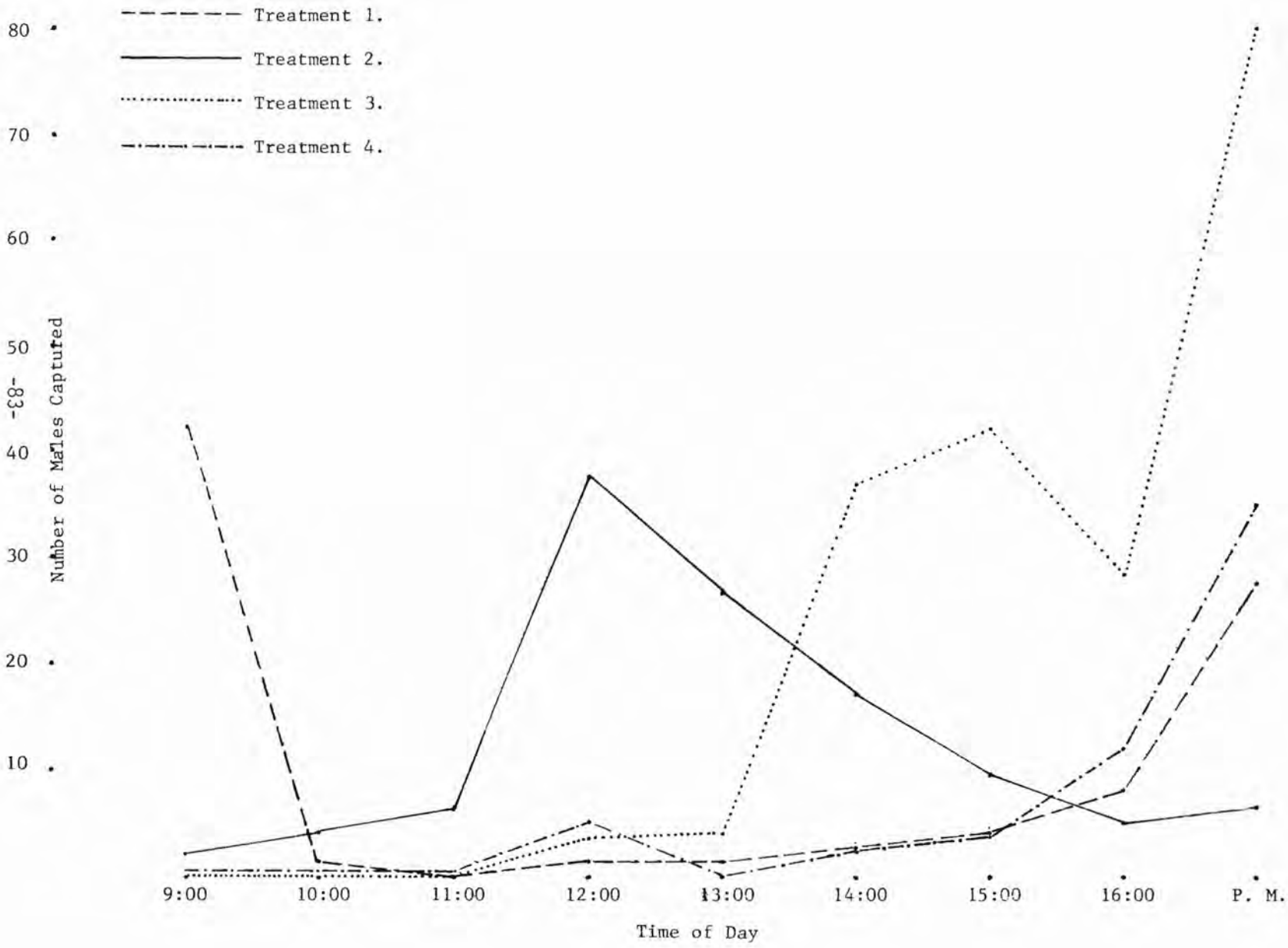


Figure 2. Competition Plot (Ashumet) July 3, 1979



In light of results from these trials a second test was run using the following male treatments:

1) Males harvested as (all-aged) pupa held and eclosed in the field
2) Males harvested as pre-pupa held and eclosed in the field
3) Males harvested as all-aged pupa held and eclosed in the laboratory (16:8 L:D) 26.7°C released the day of eclosion
4) Males harvested as all-aged pupa held and eclosed in the laboratory (16:8 L:D) 26.7°C released after 24 hours cool treatment (9°C), irradiated 15 krads.

All treatments were reared in the laboratory under standard conditions. Recovery of males from these treatment groups is presented in Table 2.

Table 2. Proportions of males recovered from various treatment groups.

Treatment	No. Release	Proportion Recovered
1	300	29.7 b
2	300	51.7 a
3	300	46.3 a
4	300	53.7 a

1/ Proportions followed by the same letter are not significantly according to Chi-square at the 0.05 level of significance.

As in the first test, irradiation or chilling does not appear to inhibit male location of pheromone sources. Males eclosed in the laboratory responded to pheromone sources as well or better than those eclosed in the field. The low recovery rate of males eclosed in the field (treatment group 1) is unexplained. The pupae for this group were from the same source as the pupae used for treatments 3 and 4. Field eclosion alone does not appear to be the reason for low recovery rates; the proportion of treatment 2 males recovered was not significantly different from that of other treatments.

Trapping in this test was begun on the day of release. Traps were placed by 1100 hours and checked for the first time at noon. Periodicity of capture for treatment 1 and 2 is comparable to what can be expected with feral males on the day they eclose (Figure 3). Males eclosed in the laboratory and released on the same day appear to have shifted their peak activity until late in the afternoon. On the following day (Figure 4) activity for treatment groups 1, 2 and 3 appear to be nearly synchronous. In other words, treatment group 3 appears to have adjusted its periodicity of activity. As in the first test, activity of chilled males is greater than expected in late afternoon. If some conclusion can be drawn from these first 2 trials, it would be that laboratory eclosion and field release has some effect on male activity on the day of release. However, thus far there is no consistency between results of the first 2 trials.

Another series of competition plots were established to further investigate the effects of chilling on male competitiveness. Plots were established and monitored using the standard circular plot design except only the outer ring (140 m radius - 44 traps) of modified Delta traps was used for monitoring male activity. Three plots were run simultaneously for this test. The following male treatments were included:

1) Males harvested as all-aged pupae, held and eclosed in the laboratory (standard conditions) - adults chilled for 24 hours ($9^{o}C$)
2) Males harvested as all-aged pupae, held and eclosed in the laboratory (standard conditions) - adults chilled for 48 hours ($9^{o}C$)
3) Males harvested as all-aged pupae, held and eclosed in the laboratory (standard conditions) - adults chilled for 96 hours ($9^{o}C$)
4) Males eclosed in the field

   Plots 1 & 2 - males harvested as all-aged pupae held in the laboratory
   Plot 3 - males harvested as all-aged pupae held in the insectary

The proportion of released males recovered from each plot is presented in Table 3.

Figure 3. Ashumet Plot-7/24/79

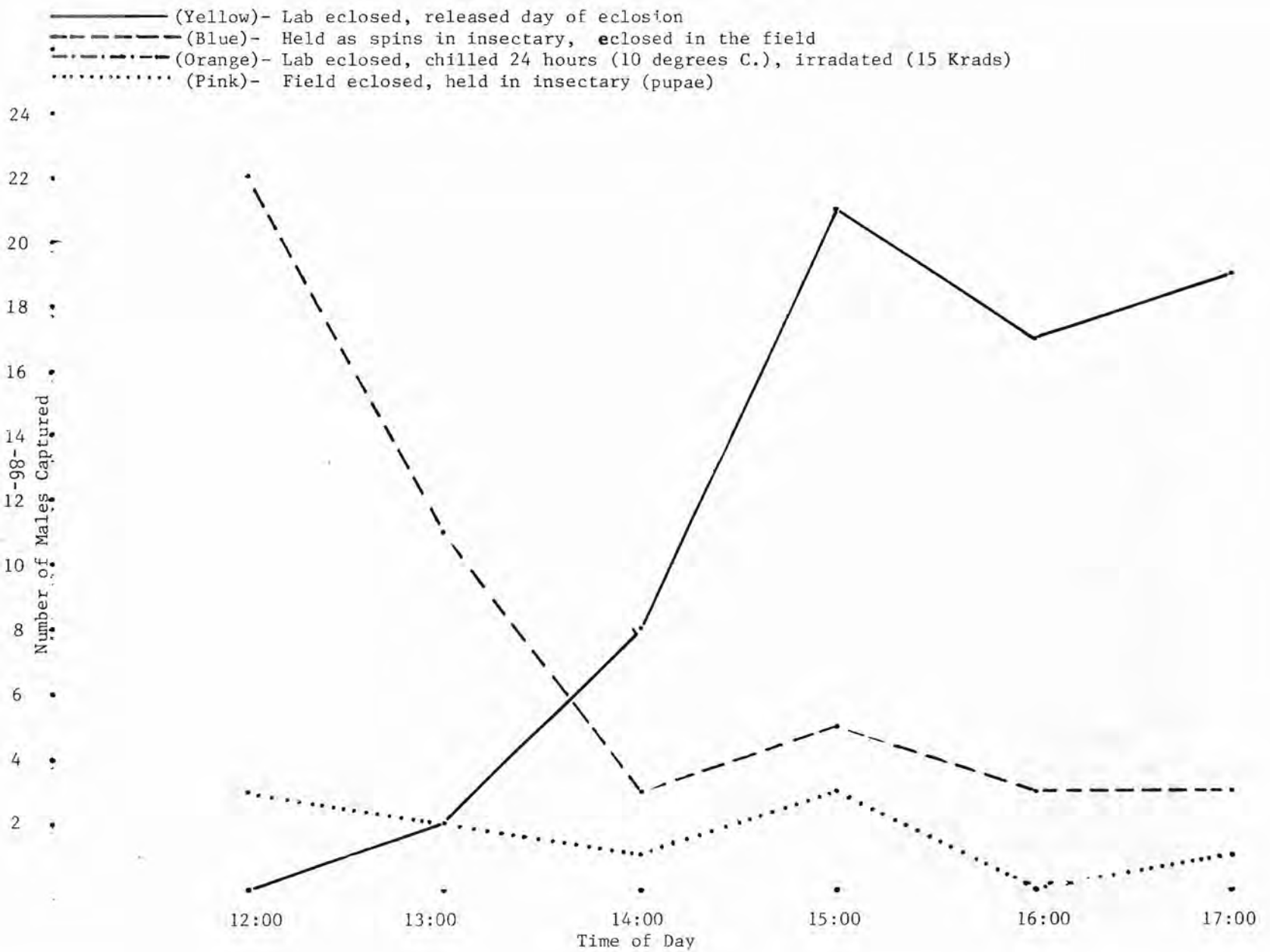


Figure 4. Ashumet Plot-7/25/79

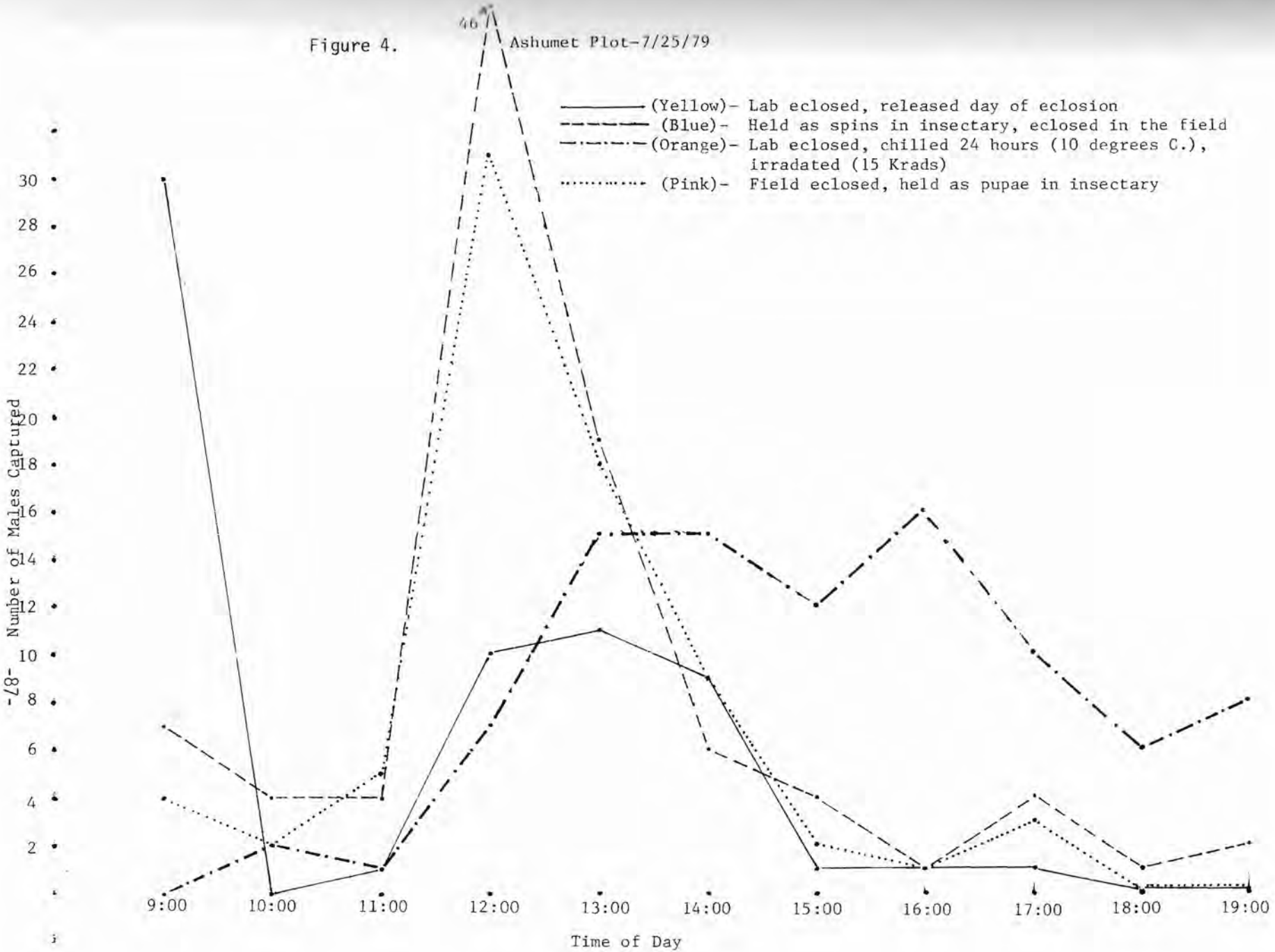


Table 3. Comparison of length of chilling on male competitiveness.

Treatment	Proportion of Released Males Recovered			
	Replicate 1	Replicate 2	Replicate 3	$\bar{x}$
	n	n	n	
1	(300) 22.3	(300) 31.7	(300) 11.7	21.9 ab
2	(275) 30.2	(300) 42.0	(300) 18.7	30.3 ab
3	(300) 42.3	(300) 50.3	(300) 28.7	40.4 a
4	(161) 10.6	(144) 25.7	(87) 1.2	12.5 b

Vertically mean proportions followed by the same letter are significantly different at the 5% level according to Duncan's Multiple Range Test.

Males chilled for the longest period (96 hours) generally were recovered in proportions greater than any other treatment. Generally as the length of chilling shortened, the proportion recovered decreased. The lowest recovery rates for all three replicates were for the field eclosed insects. Male treatment 4 was eclosed in the field on 8/6/79, all other treatments were released by 8:30 a.m. on 8/7/79. Traps were checked hourly from 9:00 a.m. to 4:00 p.m. on 8/7 and 8/8. Potting male catches against time demonstrates similar periodicities of responses for all treatment groups on both days. Figures 5 and 6, present the male captures on 8/7 and 8/8 for Replicate 2. Results of this replicate were typical of results of the other two replicates except that greater numbers of males were captured and periodicity of capture was more clearly defined. No clear distinction can be made between the periodicities of capture for the 4 treatment groups, except that chilling for lengths of time does appear to shift the periodicity of repose on either the day of release or the day after release.

In a similar trial the following treatment groups were released.

1) Males harvested as all-aged pupae held and eclosed in the field on 7/18
2) Males harvested as all-aged pupae held and eclosed in the laboratory released the day of eclosion 7/18
3) Males harvested as all-aged pupae held and eclosed in the laboratory chilled 9°C - irradiated 15 krads released 7/19, 24 hours after eclosion
4) Males harvested as all-aged pupae held and eclosed in the laboratory chilled 9°C, released 7/19, 24 hours after eclosion

Figure 5.

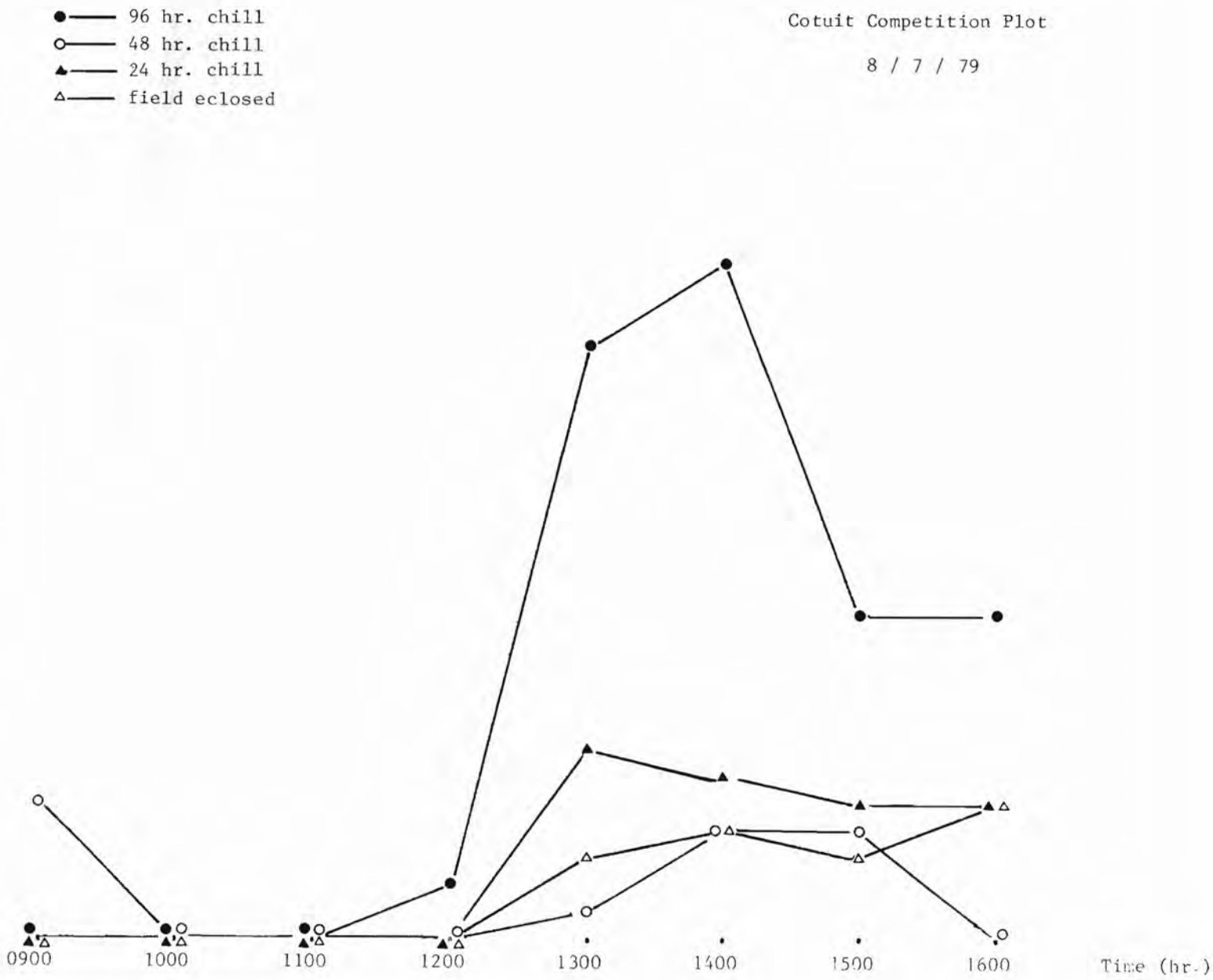
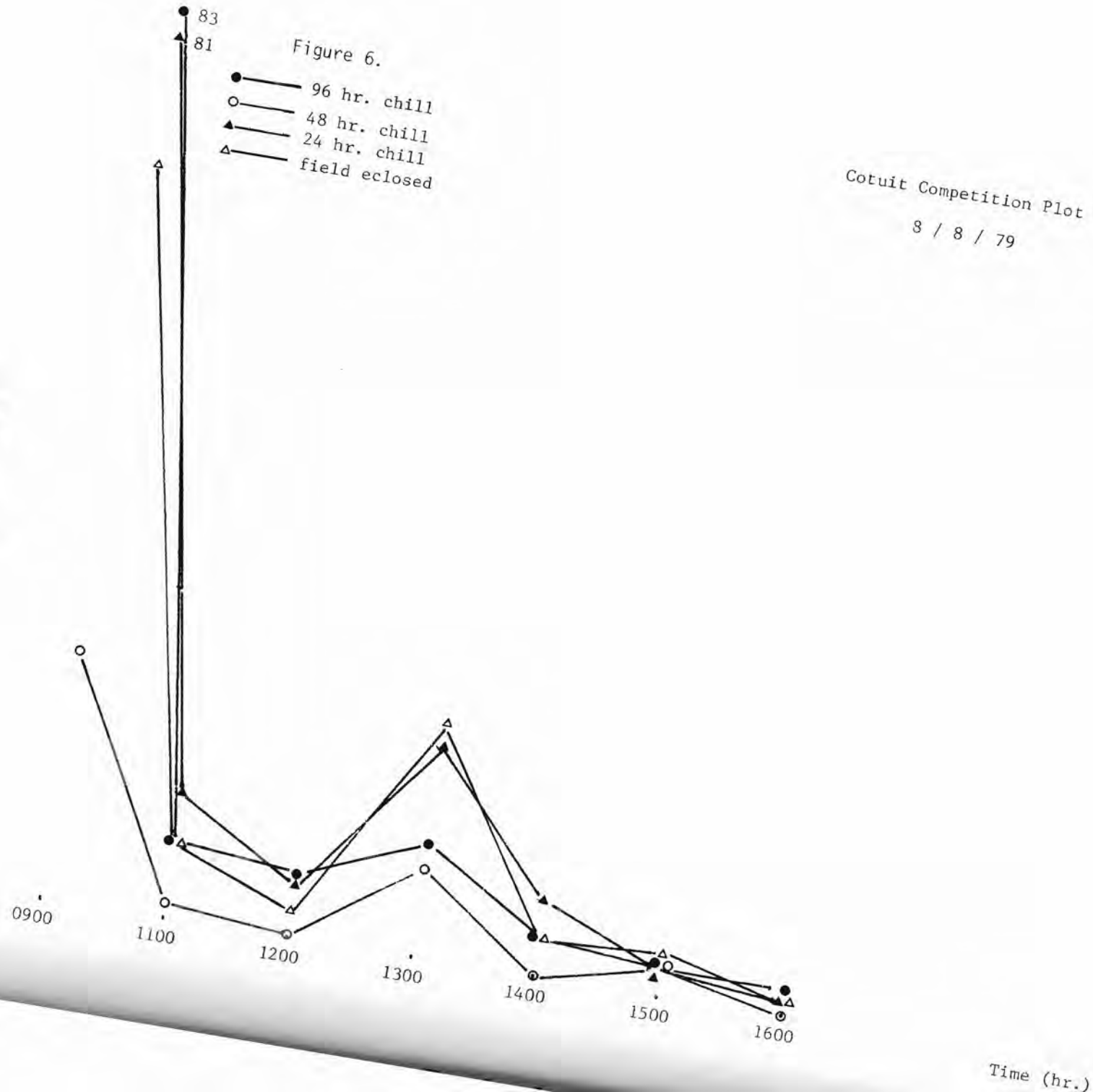

96 hr. chill
48 hr. chill
24 hr. chill
field eclosed
Cotuit Competition Plot
8 / 7 / 79
Number of Males Caught
0900
1000
1100
1200
1300
1400
1500
1600
Time (hr.)

Figure 6.



Cotuit Competition Plot

8 / 8 / 79

Recovery of the 4 treatment groups is presented in Table 4.

Table 4. Proportions of male treatments recovered.

Treatment	n=	% Recovered
1	293	36.5 b
2	298	41.3 ab
3	296	37.8 b
4	293	47.4 a

Vertically proportions not followed by the same letter are significantly different according to Chi-square at the 5% level of significance.

Chilled males (treatment 4) were again recovered in a larger proportion than other treatments and significantly greater than field eclosed insects. Males that eclosed in the laboratory and were released the same day displayed a larger amount of activity on that day than normally would be expected for 0-day old males. On the 19th, all groups of males displayed nearly the same periodicity of capture regardless of treatment. Activity for the four treatments also appears synchronous on 7/20/79, Figure 7.

To evaluate the impact of chilling and packaging (simulated shipment conditions) on male competitiveness the following treatments of males were released in a standard circular plot.

1) Males harvested as all-age pupae held and eclosed in the laboratory released the day of eclosion
2) Males harvested as all-aged pupae held and eclosed in the laboratory placed in a bio mailer 24 hours (9°C) irradiated 15 krads
3) Males harvested as all-aged pupae held and eclosed in the laboratory placed in a bio mailer 48 hours (9°C) irradiated 15 krads
4) Males harvested as all-aged pupae held and eclosed in the laboratory held 24 hours 16:8 L:D, photoperiod, irradiated 15 krads

Males from treatment group 1 were released on 8/7, other treatment groups were released on 8/8 and 8/9. Traps were monitored hourly on 8/8, (Table 5).

Figure 7. Competition Plot

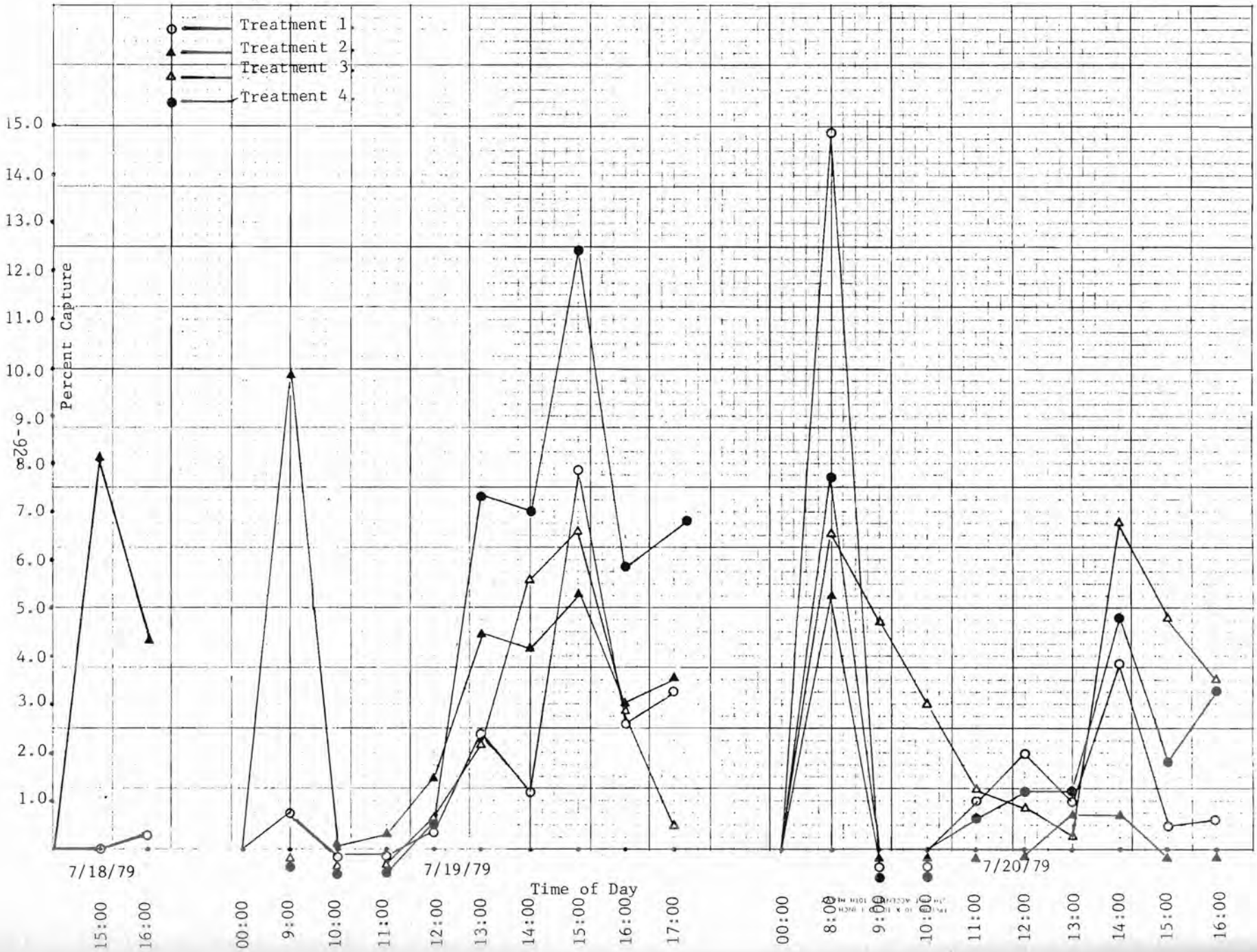


Table 5. Proportions of various male treatments recovered by 1600 hours on 8/9/79.

Treatment	Number of males Released	Number of males Recovered	Proportion Recovered
1	300	119	39.7 a 1/
2	285	73	25.6 b
3	385	28	13.8 c
4	290	112	38.6 a

1/ Vertical proportions not followed by the same letter are significantly at the 5% level according to Chi-square.

Recovery of males from treatment 3 was extremely low. Those which had been held for 48 hours in a bio mailer (9°C) were not physically damaged (i.e. wing scales intact and wings not torn) when released. However, a proportion of males from this treatment group never left the release site. On 8/10/79 there were still 60, apparently normal males from this treatment group at the release site. Treatment group 2, or the males that were held in a bio mailer for 24 hours appear to disperse as rapidly as treatments 1 and 4, however, their after disperal flight may have been impaired and this resulted in the lower recovery ratio. Results of this trial if repeatable would argue against shipping adults in a condition where they were not exposed to a photoperiod. Figures 8 and 9 present the periodicities of capture of these four treatment groups. Again a large amount of activity for all treatments occurred after 1600 hours on 8/8. This amount of late afternoon activity is unusual from past experience.

Figure 8. Male captures on Route 28 Plot 8/8/79

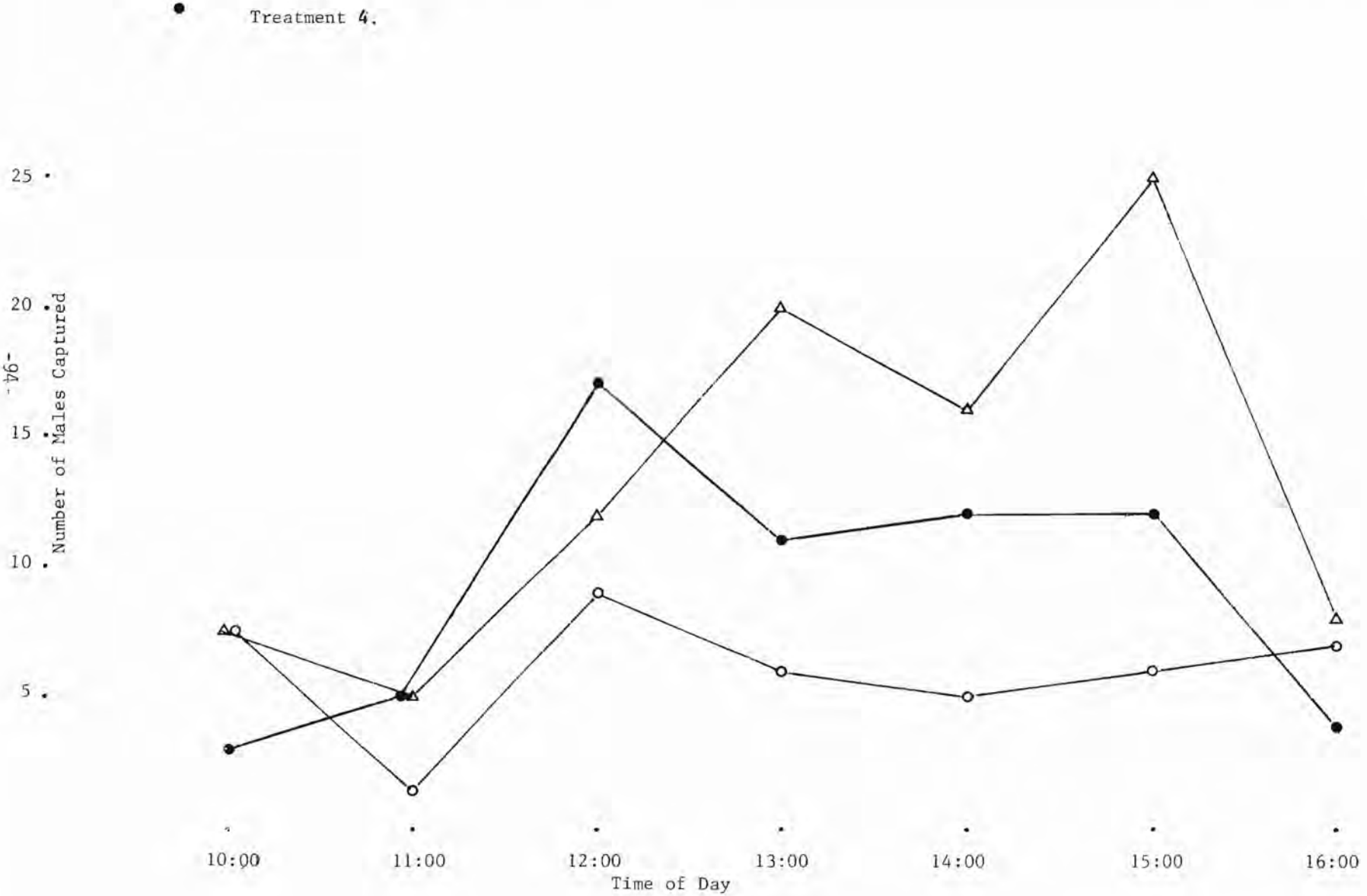
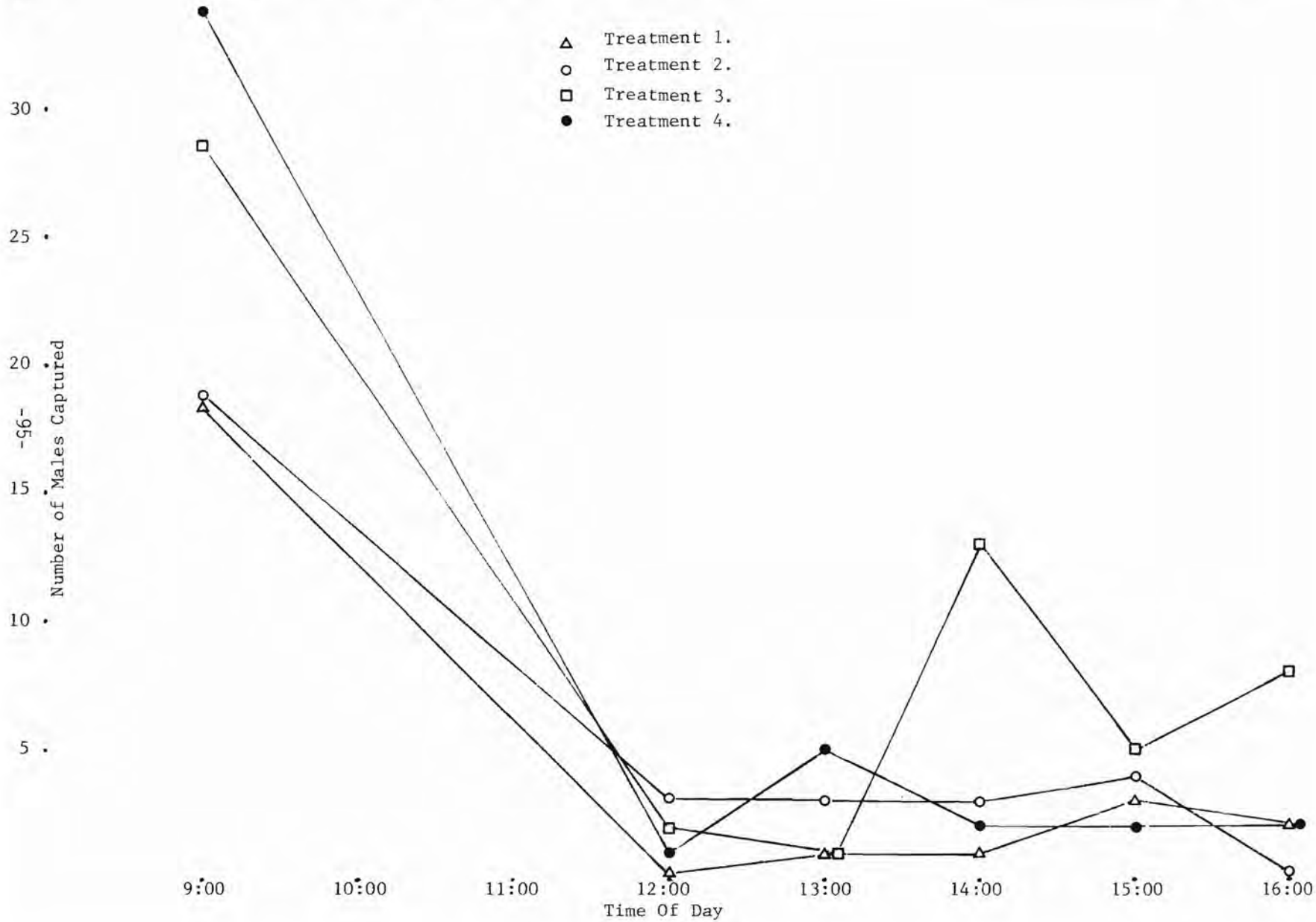


Figure 9. Males captured on Route 28 Plot 8/9/79



Project Number: GM 9.2.2
Project Title: Efficacy of Different Overflooding Ratios of Sterile Males in Simulated Populations
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: V. C. Mastro, T. M. ODell

Ratio tests were carried out between 6/26 - 7/1 and between 7/31 - 8/5, 1979. Sterile to fertile release ratios of 50:1 and 10:1 were simulated on 40 ha plots for a total of 10 days. Because of shortfalls in rearing, enough males were not available to run the planned 100:1 overflood ratio plot.

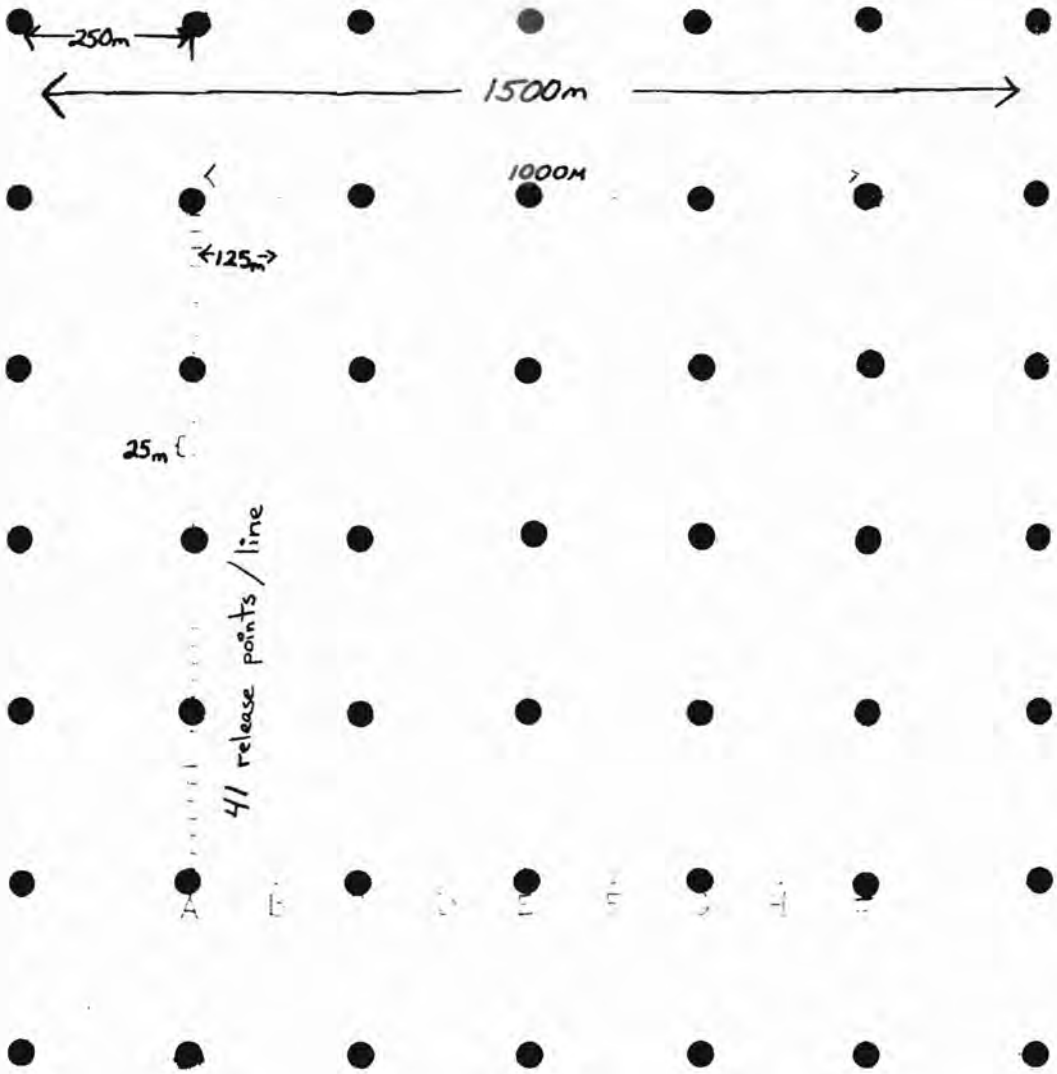
The small wooden A-frames used for placement of females in ratio plots facilitated generally high recovery rates. A total of 618 females or egg masses were recovered between 6/26 - 7/1, and 602 were recovered between 8/1 - 8/4. Calculated recovery ratios for these dates were 61.5% and 74.9% respectively. Egg masses for these plots are now in chill ($4^{o}C$). After 120 days of chilling egg masses will be placed in a high humidity chamber and allowed to hatch. Egg masses from the trials will begin to be removed from chilling in late November. Results will be summarized by February.

Project Number: GM 9.2.3
Project Title: Trial Sterile Male Tests in a Simulated Sparse Population
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: V. C. Mastro and T. M. ODell

A simulated sterile male trial was conducted between 7/10 and 7/30/79. Because of shortfalls in male production, the original plot design was modified. The overall dimensions of the plot were reduced from a 1750 m square to 1500 m square, or a reduction from 306 ha to 225 ha. A 7 x 7 grid (250 m spacing) was established over the 225 ha area to serve as release sites for sterile males. Of the 225 ha the central 100 ha was used to simulate a feral population. Within the 100 ha, 9 parallel lines 125 m apart were established. Every 25 m along each line a possible release site for fertile insects was positioned giving a total of 369 possible sites (Figure 1). Release sites of both fertile males and females were randomized each day. Fertile insect density was also reduced from the level prescribed in the original work plan. The lowest simulated feral density was dropped. The adjustments were made to assure that the number of males available would fulfill the needs throughout the test.

As in the ratio trials, recovery rates of placed females were high at the highest overflooding ratio (week 1, 100:1) 74.4%. During the second (50:1) and third week (10:1) of the test 76.9% and 77.7% of the females were recovered respectively. Egg masses from females recovered in this test were embryonated for 28 days and then placed in chilling (4°C). Hatch data will be tallied from these masses beginning in December and results should be summarized by January.

SIMULATED STERILE MALE RELEASE PLOT - 1979



225 ha total study area

100 ha fertile release area 369 fertile insect release points

Season long female density: 26 /ha

FERTILE ♀ / day	FERTILE ♀ / week	NO. STERILE MALE/ day	OVERFLOODING STERILE : FERTILE RATIO
29	203	2957	100 : 1
57	399	2857	50 : 1
216	[illegible]	[illegible]	[illegible] : 1

● - sterile male release point

Project Number: GM 9.2.5
Project Title: 1979 Field Evaluation of Microdispersable Formulations of Disparlure for Mating Disruption
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: C. P. Schwalbe, E. C. Paszek

This project was undertaken to evaluate the effectiveness of three slow-release formulations of disparlure in disrupting gypsy moth mating. The formulations studied were: Conrel hollow fibers, Hercon flakes and NCR microcapsules. The fibers were applied with specialized equipment and polybutene was the sticker. Hercon flake application also required specialized equipment and the sticker was RA-1645 latex. The standard formulation of NCR microcapsules was applied with conventional equipment. Treatments were applied to 40 A plots at the time of first adult flight in Freetown State Forest. Application rates were 8 and 0.8 g/A. Efficacy was evaluated by monitoring male capture in (+)-disparlure baited traps and determining the incidence of mating of laboratory-reared female moths placed in the plots. Each plot contained 10 traps and 10 female moths. Traps were checked and female moths replaced every 3rd day.

Results are summarized on the following table. It is noted that at the 8 g/A rate, the Hercon and Conrel formulations consistently reduced trap catch and female mating to a degree greater than the NCR sprays. However, this difference was not observed at the lower rate (0.8 g/A). An application error occurred and one Conrel plot scheduled for 8 g/A received only 4 g/A. This appeared to result in an increase in mating; trap catch remained essentially unchanged. It is interesting, that while mating frequency was similar in 8 g/A Conrel and Hercon treated plots,nearly 3 times more males were captured in traps in Hercon treated plots than in traps in Conrel treated plots.

A more detailed report is being prepared for publication and will be included in the next laboratory report.

1979 MATING DISRUPTION TESTS
Otis Methods Development Center

Formulation	Rate	♀ Mated	% Mated	♂ Trapped	
Hercon	8 g/A	2/83	2.0	339	
		8/85	9.4	261	
		11/78	14.1	520	
		21/264	8.0	1120	(373)
Conrel	8g/A	3/95	3.2	104	
		10/98	10.2	149	
		13/193	6.7	253	(126)
Conrel	4g/A	27/91	29.7	211	
NCR	8g/A	21/94	22.3	637	
		29/95	30.5	352	
		35/109	32.1	634	
		85/298	28.5	1623	(541)
Hercon	.8g/A	39/84	46.4	551	
		36/89	40.4	811	
		48/86	55.8	1228	
		123/259	47.5	2590	(863)
Conrel	.8g/A	40/93	43.0	598	
		39/87	44.8	672	
		46/95	48.4	1171	
		125/275	45.5	2441	(813)
NCR	.8g/A	30/77	39.0	805	
		47/92	51.1	414	
		55/93	59.1	1098	
		132/262	50.4	2317	(772)
Check		48/90	53.3	1179	
		89/104	85.6	1926	
		92/102	90.2	1409	
		229/296	77.4	4514	(1504)

SUMMARY

	8g/A		4g/A		.8g/A		Check	
	% Mated	♂ Trapped	% Mated	♂ Trapped	% Mated	♂ Trapped	% Mated	♂ Trapped
Hercon	8.0	373			47.5	863		
Conrel	6.7	126	29.7	211	45.5	813	77.4	1504
NCR	28.5	541			50.4	772		

CPS 11/13/79

Project Number: GM 6.3.6
Project Title: Establishing Standards
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: John Allen Tanner and Terry Buck

The purpose of this project is to develop insect quality monitoring techniques for use in the rearing facility to identify effects of altering rearing conditions on quality. Data are collected for each strain/generation and are used to establish standards, develop life tables, and detect changes from normal development so that corrective action can be taken.

Developmental and reproductive data were collected with the modified Tanner-Houle procedure (Tanner and Buck 1979). A standard was developed with these data. Daily production is compared to this standard with significant variation indicating a possible change in colony development.

The only change in the modified Tanner-Houle procedure is the use of the mean larval stage to compare larval development rate instead of the percentage of larvae/developmental stage. The mean larval stage expression is better lent to statistical analysis when comparing the colony to the standard. Five cups of larvae are still randomly selected on the 7th, 14th and 21st post-infest day. The larvae are pooled and the total number of larvae per developmental stage determined. The mean larval stage is determined by the following formula:

$$\frac{\Sigma\,(\#\text{ larvae/developmental stage x the development stage }\#)}{\text{Total }\#\text{ larvae}}$$

Table 1 compares the developmental and reproductive data of the colony insects reared from April 13, 1979 to August 22, 1979 to the standard. Table 2 lists the significant developmental and reproductive differences between the colony insects and the standard insect. The reason(s) for these differences are presently unknown but may be due to degraduation of the diet or dietary ingredients. Poor nutrition reduces larval survival and results in smaller pupae (Barbosa and Capinera 1977, Hough and Pimentel 1978). Smaller female pupae produce adult females which deposit fewer eggs (Maksimovic 1958, Campbell 1978, Hough and Pimentel 1978). In the Otis colony, smaller pupae have less banding (deformity) (Bell, personal communication). This accounts for the lower percentage of female pupal deformity.

Personal observations have indicated that during the April 13 to August 22nd rearing period, the gypsy moth diet often became hard and unpalatable near the end of the larval developmental period. The male larvae often pupated earlier to escape starvation which probably resulted in the lower DT_{50} for the adult males. The female larva often pupated much later than normal. The weekly trends of the major developmental and reproductive differences between the New Jersey colony and the standard are presented in Figures 1-9.

Table 1. Performance of the New Jersey laboratory strain of gypsy moth under mass production. [1/]

Larval Development (Mean larval stage)	Standard [2/]	Colony [3/]
7 days	2.0 ± .27 a	2.1 ± .19 a
14 days	3.7 ± .25 a	3.9 ± .22 b
21 days	5.3 ± .16 a	5.2 ± .15 a
Pupal Weights		
Males (gms)	.71 ± .03 a	.66 ± .04 b
Females (gms)	2.37 ± .14 a	2.23 ± .15 b
% of Male pupae		
31PIB (Cal DT_{50})	48.0 ± 19.3 a	52.9 ± 19.3 a
% Female pupae		
32 PIB (Cal DT_{50})	50.6 ± 17.2 a	28.4 ± 17.4 b
% Pupal deformity		
Males	4.8 ± 4.0 a	4.4 ± 2.8 a
Females	86.6 ± 8.1 a	83.5 ± 8.6 b
% Survival		
(Neonate to pupae)	80.3 ± 7.8 a	75.9 ± 10.0 b
Developmental Time to Adults (DT_{50} days)		
Males	44.5 ± .9 a	43.4 ± .9 b
Females	43.2 ± .7 a	43.2 ± 1.3 a

Larval Development (Mean larval stage)	Standard 2/	Colony 3/
% Adult Deformity		
Males	1.5 ± 2.6 a	1.2 ± 2.1 a
Females	8.0 ± 5.4 a	6.6 ± 4.7 a
% Adult Recovery		
Males	97.8 ± 5.0 a	97.8 ± 2.8 a
Females	92.1 ± 8.2 a	93.6 ± 6.2 a
% Survival (Neonate to Adult)		
Males	78.6 ± 9.0 a	73.8 ± 12.2 b
Females	74.3 ± 9.2	70.5 ± 13.2 a
Sex Ratio		
# Males/Females	1.2 ± 0.5 a	1.2 ± 0.3 a
% Mating pairs	92.3 ± 7.6 a	90.4 ± 8.5 a
Eggs laid/female	1055.1 ± 122.9 a	986.1 ± 104.0 b

1/ Means within a row followed by the same letter are not significantly different (P = 0.05).

2/ Neonates placed onto diet from January 31, 1979 to April 10, 1979.

3/ Neonates placed onto diet from April 13, 1979 to August 22, 1979.

Table 2. The major developmental and reproductive differences between the New Jersey colony 1/ and the standard 2/.

The New Jersey Colony had:

I. A higher mean larval stage on the 14 PID
II. Lower pupa weights
III. Fewer female pupae present on the 32 PID (Cal DT_{50})
IV. Lower female pupae deformity
V. Reduce survival from neonate to pupae
VI. A reduced DT_{50} for adult males
VII. Reduced male survival from neonate to adult
VIII. Fewer eggs laid/female

1/ Neonates placed onto diet from April 13, 1979 to August 22, 1979.

2/ Neonates placed onto diet from January 31, 1979 to April 10, 1979.

References Cited

Barbosa, P., and J. L. Capinera. 1977. The Influence of Food on Developmental Characteristics of the Gypsy Moth, Lymantria dispar (L), Can. J. Zool., 55(9):1424-1429.

Campbell, R. W. 1978. Some Effects of Gypsy Moth Density of Rate of Development, Pupation Time and Fecundity. Ann. Entomol. Soc. Amer. 71: 442-448.

Hough, J. A., and D. Pimentel. 1978. Influence of Host Foliage on Development, Survival and Fecundity of the Gypsy Moth, Environ. Entom. 7(1): 97-102.

Maksimovic, M. 1958. Experimental Research on the Influence of Temperature upon the Development and the Population Dynamics of the Gypsy Moth. Posebno Izdanje Bioloskog Inst. NR SRbije 3:1-115. Trans. from Servo-Croatian 1963. OTS 61-11203: 1-95.

Tanner, J. A. and T. Buck. 1979. Establishing Standards, APHIS, Laboratory Report October 1, 1978 - March 31, 1979, 48-53.

Figures 1 through 9. Weekly trends of the major developmental and reproductive differences between the New Jersey colony and the standard.

Figure 1.- Mean Larval Stage - Day 14 PID

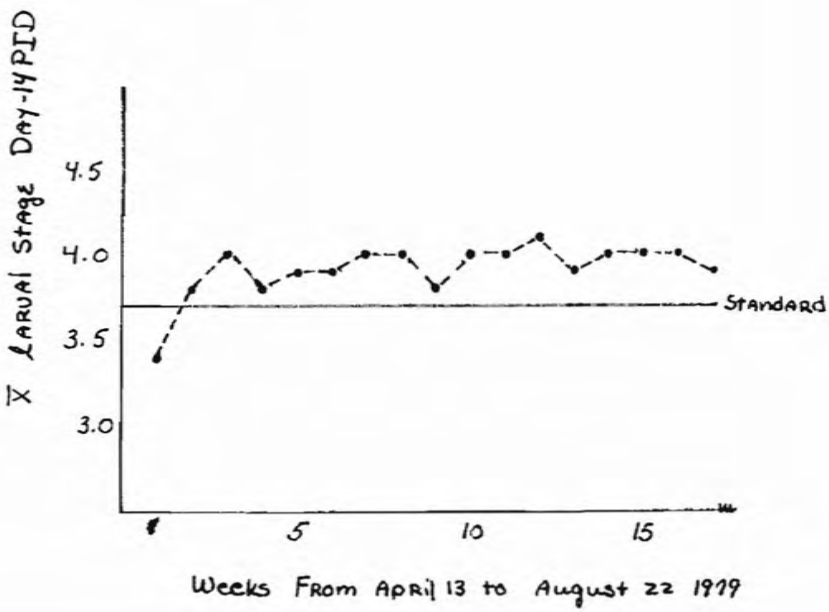


Figure 2. - Mean Male Pupal Weight (gms.)

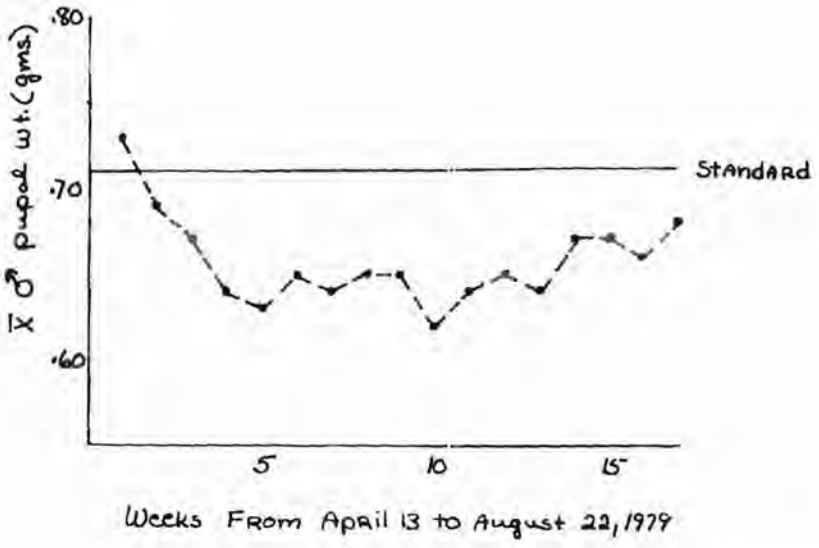


Figure 3.- Mean Female Pupal Weight (gms)

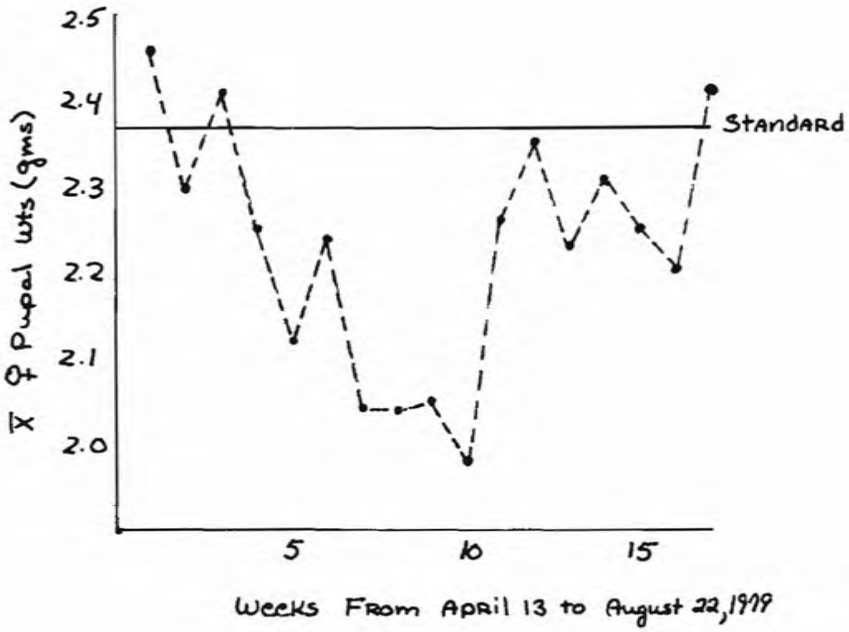


Figure 4.- Mean percentage of female on the 32 PID (Cal DT_{50})

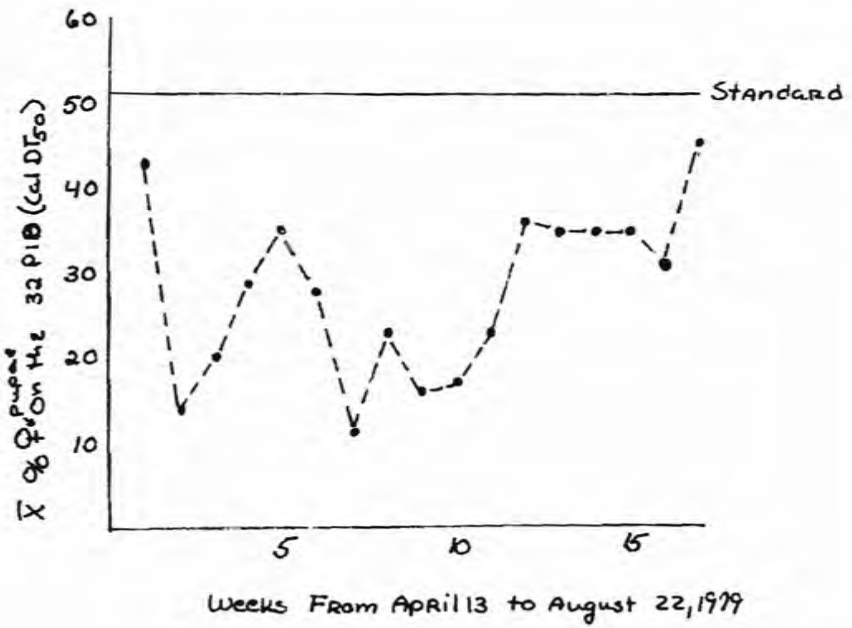


Figure 5.- Percentage of female pupae with deformity.

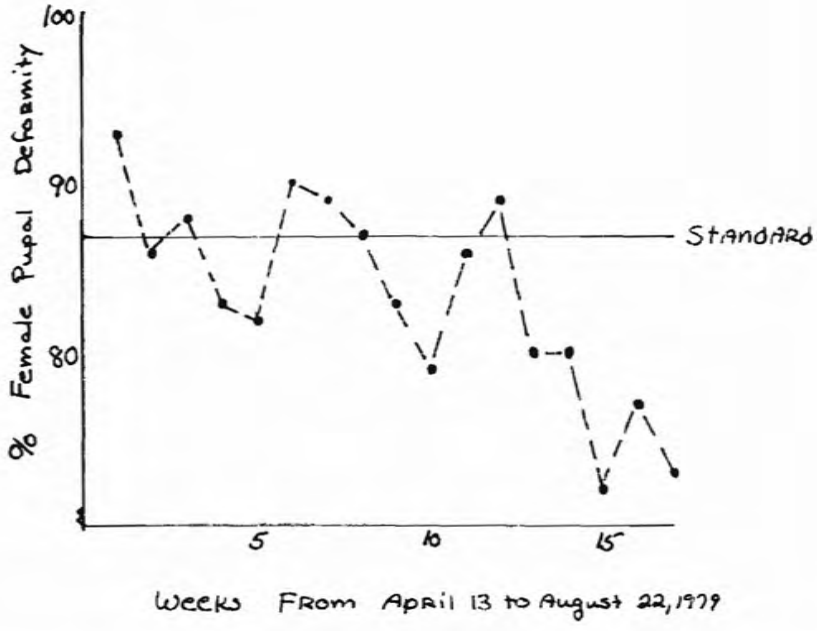


Figure 6.- Percent Survival Neonate to Pupa

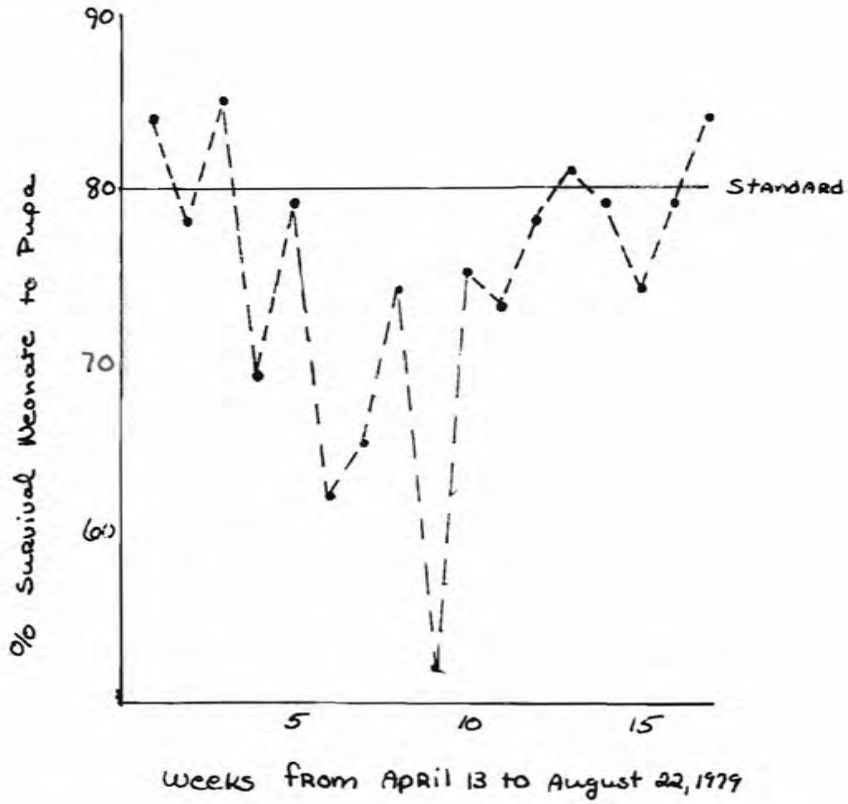


Figure 7. - Mean DT_{50} Adult Males Emergence (Days)

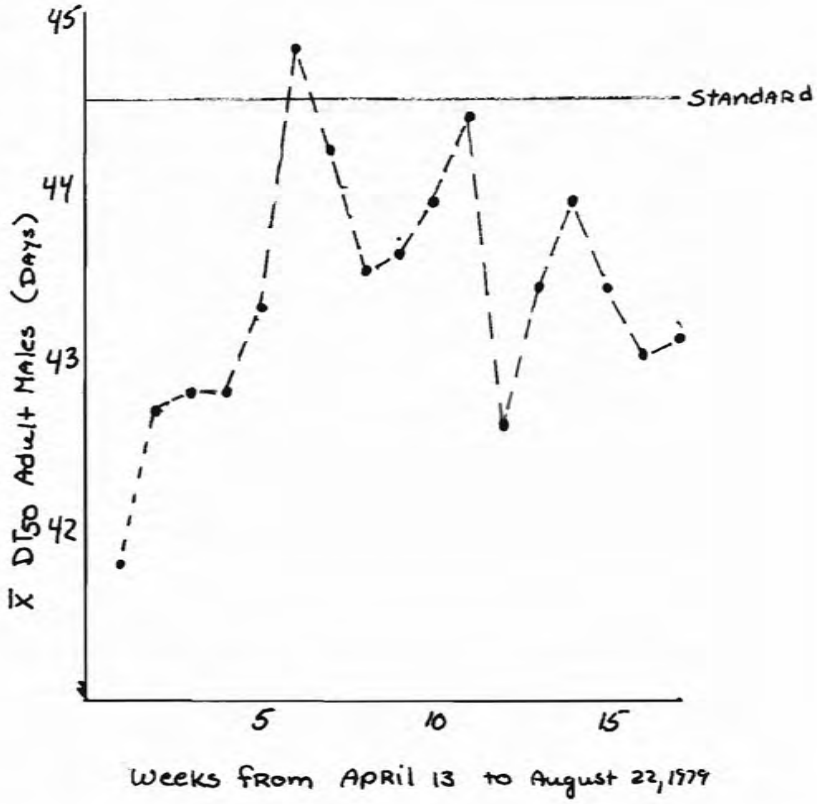


Figure 8.- Percent Survival Neonates to Male Adults.

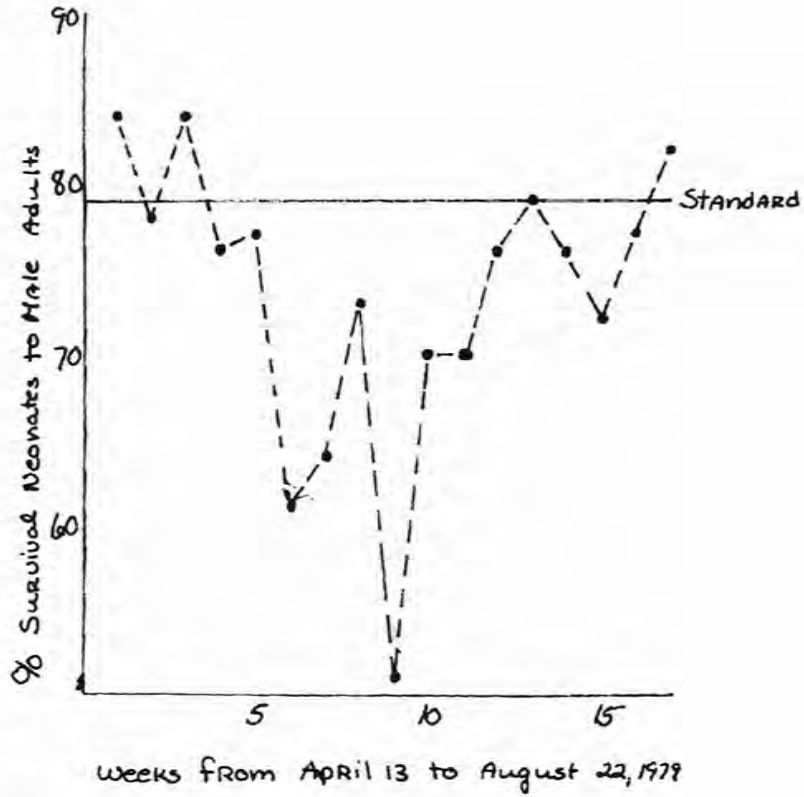
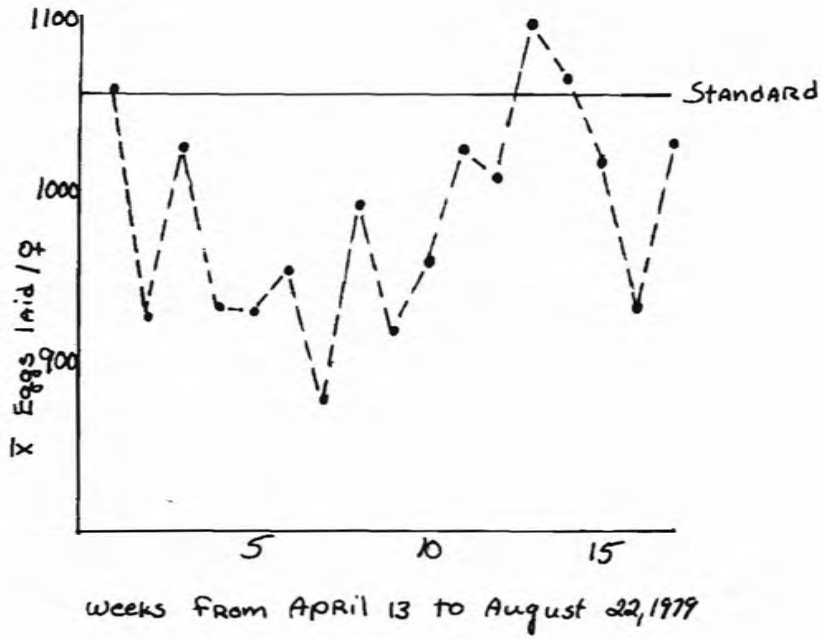


Figure 9.- Mean number of Eggs laid / female.



Project Number: GM 7.3.4
Project Title: Insect Production and Distribution
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: L. F. Kennedy, J. J. Baker, O. T. Forrester

The primary objective of the rearing facility of this laboratory is to produce sufficient quantities of life stages of the gypsy moth in support of research projects at this laboratory and at several universities and experiment stations in the United States and foreign countries.

Following is a summary of production and distribution of such material.

A. Production -	Infested	3,367,284	Neonates
	Refrigerated	31,026	Egg masses

B Distribution

1. Methods Development and A.R.S.

Insecticide screening	211,300	Larvae
Sterile male	19,935	Larvae
	662,330	Male pupae
	15,000	Female pupae
	37,515	Male spins
Virus Project	178,835	Larvae

2. Cooperators

	♂ Pupae	♀ Pupae	Egg masses
Michigan State University R. Carde	67,550	9,050	
Agricultural Research Center Beltsville, MD - R. Webb	17,925	7,500	
Conn. Agricultural Exp. Station - J. Anderson		14,600	10
Massachusetts University P. Barbosa		3,800	
Forest Service - W. Rollinson			35
New Jersey Dept. of Agric. W. Metterhouse			511

	♂ Pupae	♀ Pupae	Egg masses
Beneficial Insects Introduction Research Lab., Newark, DE Roger Feuster			20
Penn State University R. Mumma			55
Clarkson College of Technology - S. Hurnung			15
Rutgers University A. Forgash			200

Over 70% of females reared were discarded.

Our new hatch chamber with controlled humidity has been in use since 10/5/79 and has resulted in a significant increase (4-5 days) of larval survival.

Project Number: GM 8.3.2
Project Title: Rearing Techniques and Production Costs
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: O. T. Forrester, L. F. Kennedy, J. J. Baker

The following rearing techniques were adopted for large scale rearing in September of 1978. The primary change is the elimination of the 21 day transfer and sexing operation. Cost of each operation is per 1000 insects.

Diet Preparation

Diet preparation and dispensing procedures have changed slightly. The addition of a Breddo Likwifier with an 80 liter capacity has improved the quality and uniformity of diet batch preparation. Labor for diet preparation and dispensing is $1.00. Cost of 84 cups and lids $2.94, diet $2.98. Cost of diet preparation and materials is $6.92.

Putting neonates on diet

Neonate larvae are placed on the diet at 12 per cup (XE-6 Sweetheart Plastics) labor $2.84. Neonates developed to pupation in the original container.

Pupal Harvest

The present pupal harvest system has not changed. Pupae are harvested from the XE-6 oz. plastic cup - cost of labor $2.35, container cost for pupae harvest $1.60.

Mating and egg harvest

This procedure has changed slightly. Container cost for mating 500 pair is $7.00. These containers can be re-used about 10 times 70 reducing the cost to $.70, labor $5.67, total cost of $6.37.

The above costs are for production rearing. The cost of rearing the colony is $22.77, the difference in cost is because insects for colony are reared 8/container. Productions costs for sterile male production should be about $13.56.

Project Number: GM 8.3.4
Project Title: Evaluating the Sampling Techniques used to Establish Standards and Monitor Production I. Egg Sampling Techniques II. Larval Development Techniques
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leaders: John Allen Tanner and Terry Buck

Introduction:

A quality control program must have sampling techniques which accurately estimate the true population mean. This requires careful evaluation of each sampling technique before it is accepted for use in a quality control program.

In this and future reports, sampling techniques proposed for use in our quality control program will be evaluated for their accuracy in expressing the true population mean. Unreliable or inaccurate techniques will be modified or discarded.

I. Egg sampling techniques:

A reliable hatch test is necessary to determine the effects of alternate rearing methods on the gypsy moth reproduction. Also, hatch tests are needed to determine the number of eggs that must be incubated for production maintenance. A dehaired sample is preferred. The number of eggs in a sample can be kept constant when the sample is dehaired compared to a non-dehaired sample. Also, a smaller sample size may be possible if several masses are dehaired and the eggs "homogenized" rather than taking a non-dehaired sample from several individual egg masses.

Tests by Tanner and Buck (1979) have shown that the hatch of a dehaired sample is reduced when the eggs are incubated directly in an environmental room (25.5^{o}C, 50-55% RH). Further testing has shown that this reduction was due to the environmental room being programmed for too low humidity and/or too high air flow. The following test was established to determine if the reduction in hatch was due to low humidity or high air flow within this room.

Methods and Materials:

An egg sample was removed from the core of an egg mass (New Jersey F_{18} chilled 120 days). The sample was dehaired by rubbing the sample between two pieces of paper. Four 20-egg samples were randomly selected and placed into individual plastic petri dishes (50 x 9 mm). One sample was placed directly into the environmental room (25.5°C, 50-70% RH). The remaining three samples were placed into desiccators located within the environmental room. Air flow was allowed into one of these desiccators by removing the top. The other desiccator was closed to prevent any air flow into it. The third desiccator was maintained at a saturated atmosphere.

Newly hatched neonates were removed daily. Percent hatch was computed based on the total number of embryonated eggs. Five masses were used per replication. Four replications were conducted over a period of time. The treatments were analyzed by an AOV test and compared with the Newman-Keuls test.

Results:

Low humidity and hot air flow caused the reduced hatch observed when dehaired eggs were incubated in the environmental room. Dehaired eggs incubated in a saturated atmosphere produced a significantly higher hatch than eggs incubated under any of the ambient humidity treatments (Table 1). There were no significant differences in hatch between eggs stored under any of the ambient humidity treatments.

Table 1. The effects of relative humidity and air flow on the percent hatch of dehaired gypsy moth eggs (New Jersey F_{18}).

Treatment	Percent Hatch 1/
Closed desiccator (100% RH)	92.1 ± 6.2 a
Closed desiccator (Ambient Humidity)	59.3 ± 20.8 b
Open desiccator (Ambient Humidity)	54.5 ± 14.4 b
Environmental Room (Ambient Humidity)	54.3 ± 9.8 b

1/ Means within a column not followed by the same letter are significantly different at the 5% level. (Newman-Keuls Test)

Incubating dehaired eggs in a saturated atmosphere is a technique useful for developing an accurate hatch test. The following test was conducted to determine if a 20-egg sample can be used to predict the hatch of an egg mass.

Methods and Materials:

A group of eggs were removed from the core of a New Jersey F_{10} egg mass (chilled 120 days) and mechanically dehaired. Two 20-egg samples were randomly selected and placed into individual petri dishes (50 x 9 mm). One dish was placed directly into the environmental room (25.5°C, 50-70% RH). The remaining dish was placed inside a desiccator (100% RH) located within the environmental room. The remaining portion of the egg mass was also placed into a petri dish and incubated directly in the environmental room.

Neonates were removed daily. Five egg masses were selected/replication. Six replications were conducted over a period of time.

Results:

The use of a saturated atmosphere greatly improves our ability to predict hatch of an entire egg mass from a 20-dehaired egg sample. There was a high correlation between the percent hatch of the whole egg masses and their corresponding egg samples incubated within a saturated atmosphere (Fig. 1, r = .62). There was very little correlation between the percent hatch of the whole egg masses and their corresponding egg samples incubated directly in the environmental room (r = .16).

There is an indication that in a saturated atmosphere, a 20-dehaired egg sample may not be accurate in predicting hatch from egg masses of low hatch. In this test, 4 out of the 30 masses hatched below 80%. However, the hatch tests predicted only one mass would hatch below 80% (Fig. 1). The mean discrepancy between the predicted and actual hatch of egg mass was 2.9% for masses with 80% or higher hatch and 21.2% for egg masses with below 80% hatch (Table 2). A sample of four is not very large. Further testing is necessary before a valid conclusion can be reached on the accuracy of a dehaired sample, in a saturated atmosphere, in predicting the hatch of an egg mass.

Table 2. The mean difference between the predicted 1/ and the actual percent hatch of gypsy moth egg masses.

Egg Masses Percent Hatch Range	Number of Masses	Mean percent Difference
80-100	26	2.9 ± 2.7
41-75	4	21.2 ± 14.1

1/ Twenty dehaired eggs/mass incubated in a saturated atmosphere.

High Humidity Chamber:

A high humidity egg incubation chamber was developed for the incubation of a large number of egg samples. A test was designed to determine if the percent eclosion of egg samples incubated in this chamber were comparable to the percent eclosion of egg samples incubated in a desiccator (saturated atmosphere).

Methods and Materials:

Ten egg samples were removed from the core of a New Jersey F_{19} egg mass. One half of the samples were dehaired and placed into individual petri dishes (50 x 9 mm). The non dehaired egg samples were also placed into individual petri dishes. One dehaired and one non dehaired sample was placed into each of the following locations:

1) Directly in the environmental room (25.5°C, 50-70% RH)
2) A desiccator located within the environmental room (100% RH)
3) On shelf 2, 7 and 13 within a high humidity chamber located in the environmental room (100% RH)

Neonates were removed daily. Five, 120 day chilled egg masses were used/ replication. Five replications were conducted over a period of time.

Results:

Only two replicates have been completed. Preliminary results indicate no difference in percent hatch between eggs incubated in the high humidity chamber and eggs incubated in the desiccator. The percent hatch is very high for both treatments.

II Larval Development Sampling Technique:

Larval development is determined on the 7th, 14th and 21st post larval infest day. Five cups of larvae are randomly selected and pooled. The total number of larvae per developmental stage is determined. The mean larval stage is then determined by the following formula

$$\frac{\Sigma\,(\#\text{ larvae/developmental stage x the developmental stage }\#)}{\text{total }\#\text{ larvae}}$$

and compared to the standard.

The following test was conducted to determine the accuracy of a 5 cup sample in predicting the mean larval stage of the whole population.

Methods and Materials:

Colony productions were sampled on the 7th, 14 or 21st post-larval infest day. Five cups were randomly selected and pooled. The mean larval stage was determined by the above formula. The mean larval stage was then determined for the corresponding colony production.

Five replications were conducted over a period of time. A paired observation t-test was used to compare the sample mean larval stage to the colony production mean larval stage.

Results:

No significant difference was observed between the samples and their corresponding population mean larval stage (Table 3). The five cup sample size is large enough to accurately predict the mean larval stage of the population.

Table 3. The mean larval stage of a five cup sample size and their corresponding population. 1/

	Post larval infest day 2/		
	7	14	21
Sample	2.1 ± .1	3.9 ± .1	5.2 ± .1
Population	2.1 ± .1	3.9 ± .1	5.1 ± .1

1/ Five replications

2/ All means within a column were not significantly different (P = 0.05)

Project Number: GM 9.3.1
Project Title: Laboratory Evaluation of Eggs Collected from Oconomowoc, WI Infestation
Report Period: April 1, 1979 - September 30, 1979
Report Type: Final
Project Leader: O. T. Forrester

This project was undertaken to evaluate the quality of the gypsy moth population found in Oconomowoc, Wisconsin. The 12 egg masses received were checked for number of eggs/mass, parasitism, percent embryonation, percent hatch and virus titer.

Methods and Materials:

The average number of eggs per mass was determined by removing all debris from the egg mass and weighing the mass. The weight of the egg mass in mg was then multiplied by 1.33.

Percent parasitization could not be determined because the egg masses were shipped in aggregate. One package of three egg masses contained live Ooencyrtis, therefore all three masses would show parasitism.

Embryonation and hatch were determined by samples taken from each mass. The samples were not dehaired or surface disinfected.

Virus titer was determined by placing neonates from the hatch test on modified hornworm diet. Observations on presence of virus were made after 14 and 21 days of development. All work was performed under a vertical flow laminar hood.

Results and discussions:

The mean egg mass weight was 694.5 mg. This calculates to 924 eggs per mass or 11,084 eggs from the 12 masses. An accurate estimate of parasitization was not possible because of aggregate storage of the egg masses, however, Ooencyrtis kuwanai was observed. Embryonation of these egg masses was 100%. Hatch, establishment on diet and survival were excellent with 92.4%, 98.7% and 95.9% respectively.

There was no evidence of virus or other diseases observed in the Oconomowoc egg masses sampled. This population appears to have an excellent potential for rapid growth.

Project Number: GM 9.3.2
Project Title: Silk Removal from Gypsy Moth Pupae
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leader: O. T. Forrester

No work is being reported this period because of complications experienced this past summer during large scale production. Data will be presented in the next semi-annual report.

Project Number: GM 9.3.3
Project Title: The Effect of Temperature on Vitamin Pre-mix Relative to Development and Egg Hatch
Report Period: April 1, 1979 - September 30, 1979
Report Type: Final
Project Leader: O. T. Forrester

In the previous report, tests indicated that boiling Hoffman LaRoche vitamin pre-mix had little effect on developmental rate, pupal weight, normality or hability of egg masses chilled for 90 days. This report compares % hatch at 90 and 120 days of storage.

	Percent hatch	
Treatment	90 days	120 days
Boiled vitamins	83.1 ± 11.8	72.9 ± 12.7
Vitamins added @90°C	82.7 ± 4.6	61.7 ± 22.3
Vitamins added @70°C	69.2 ± 14.4	68.2 ± 3.5
Boiled vitamins No oils added	52.7 ± 24.6	61.5 ± 8.9

Egg hatch was lower in all treatments after 120 days of chilling. Egg hatch was comparable between treatments at 120 days.

Project Number: GM 9.3.4
Project Title: Alternatives to Wheat Germ in Artificial Gypsy Moth Diet
Report Period: April 1, 1979 - September 30, 1979
Report Type: Final
Project Leader: O. T. Forrester

In the preliminary report on this project it was observed that 100% of the adult male gypsy moths reared or oatmeal diet with linseed oil deleted had abnormal wings. It was also observed that neonate larvae did not develop beyond the second instar if cholesterol was omitted from the oatmeal diet.

Sterols

An 8 treatment test was conducted to determine the level of cholesterol required for normal larval development. Cholesterol levels tested were 0, 25, 50, 75, 125, 250 and 500 mg/l. The eighth treatment was a modified hornworm control. A similar test design was used to determine the B-sitosterol level required for normal development. B-sitosterol levels tested were 0, 0.125, 0.25, 0.50, 1.0 and 2 gm/l. The diets were not changed in these tests.

The addition of 250 mg/l of cholesterol to the oatmeal diet resulted in growth characteristics comparable to those from the HW control. Below this level, some insects developed normally while others were slow and still others did not establish at all.

Table 1. Growth and development of gypsy moth larvae on oatmeal diet with varying amounts of cholesterol added.

mg cholesterol/l	Time to adults (days)		% Neonates to adult	% Normal	
	♂	♀		♂	♀
0	None	None	0	-	-
25	None	None	0	-	-
50	50.9 ± 5.0	54.2 ± 5.3	16.8	100	91.7
75	51.9 ± 5.8	55.4 ± 5.6	24.4	88.9	93.8
150	47.5 ± 4.3	50.5 ± 4.4	73.1	100	87.9
250	44.8 ± 2.2	47.8 ± 2.8	93.1	100	98.5
500	46.1 ± 3.4	48.9 ± 3.9	89.4	100	100
Hornworm control	43.2 ± 1.5	44.6 ± 2.3	89.4	95.5	94.0

In the B-sitosterol portion of this study a level of 500 mg/liter gave results comparable to the control. Below this level the results were similar to the cholesterol study.

Table 2. Growth and development of gypsy moth larvae on oatmeal diet with varying amounts of B-sitosterol added.

mg B-sitosterol/l	Time to adults (days) ♂	♀	% Neonates to adult	% Normal ♂	♀
0	59.0 ± 7.5	61.7 ± 4.0	4.4	100	100
125	51.9 ± 6.8	54.0 ± 6.5	15.0	93.3	88.9
250	47.4 ± 4.7	48.9 ± 3.4	40.6	93.5	89.5
500	45.4 ± 2.2	46.8 ± 3.6	80.6	98.4	91.0
1000	44.6 ± 1.5	44.9 ± 2.5	91.3	100	88.4
Control*	44.6 ± 1.7	45.2 ± 2.6	89.4	100	88.4

* Control diet contained 1 g/l cholesterol

Fatty acids

A 7 treatment test was conducted to determine the minimum amount of raw linseed oil necessary for normal adult male development on the oatmeal diet. Levels tested were 0, 0.125, 0.25, 0.50, 1 and 2 ml raw linseed oil/l; treatment 7 was a modified hornworm control. A second test was conducted to determine the level of linolenic or linoleic acid necessary for normal adult male wing formation. Levels previously mentioned for the raw linseed oil tests were used except 2 ml/liter.

Larvae reared on oatmeal diets developed normally through the pupal stage when compared to the controls regardless of the amount of linseed oil or fatty acid added. All developmental data were comparable until adult emergence. Adult males reared on diets deficient in linseed oil or linoleic and linolenic acids showed gross abnormalities in both sets of wings and the abdomen; those reared on the controls were normal. Results are summarized in Tables 3, 4 and 5.

Table 3. Growth and development of larvae on oatmeal diet with increasing concentrations of raw linseed oil.

Table 3. (Cont'd).

ml raw linseed oil/liter	Time to adults (days) ♂	♀	% Neonates to adult	% Normal ♂	♀
0.0	44.5 ± 1.9	47.6 ± 1.8	41.3	0.0	76.9
0.125	45.9 ± 3.4	48.9 ± 3.3	56.3	0.0	89.2
0.25	46.4 ± 2.9	49.9 ± 2.6	64.4	44.9	77.8
0.50	46.8 ± 2.8	49.1 ± 2.8	75.0	93.0	73.0
1.0	46.6 ± 3.2	49.6 ± 2.8	65.6	100.0	75.9
2.0	46.9 ± 3.6	50.2 ± 3.1	73.1	100.0	69.4
Hornworm control	44.5 1.5	47.6 3.3	81.9	94.7	75.9

Table 4. Growth and development of larvae on oatmeal diet containing increasing amounts of linolenic acid.

ml linolenic acid/l	Time to adult (days) ♂	♀	% Neonates to adult	% Normal ♂	♀
0.125	44.6 ± 1.9	46.2 ± 2.6	86.3	0.0	87.8
0.25	44.0 ± 1.4	45.9 ± 2.4	90.6	7.2	86.8
0.50	43.4 ± 1.3	45.4 ± 2.6	93.7	72.2	88.5
0.75	43.8 ± 1.3	45.4 ± 2.4	96.25	97.4	93.4
1.0	43.6 ± 1.8	45.4 ± 2.7	95.6	100.0	79.7
1 ml raw linseed oil/l	43.5 1.9	44.5 2.7	91.9	100.0	79.6

Table 5. Growth and development of larvae on oatmeal diet containing increasing amounts of linoleic acod.

ml linoleic acid/liter	x time to adult ♂	♀	% Neonate to adult	% Normal ♂	♀
0.125	43.6 ± 1.8	44.6 ± 2.4	77.5	0	85.0
0.25	43.3 ± 1.5	45.2 ± 2.8	83.8	0	79.9
0.50	44.2 ± 2.0	45.1 ± 2.7	80.0	0	65.6
1.0	43.8 ± 2.2	44.9 ± 2.6	86.3	0	80.8
1.0 raw linseed oil	43.5 1.9	44.5 2.7	91.9	100	75.9

Females appeared to be uneffected by the low fatty acid content of the diets. They emerged normally with only small percentages appearing abnormal, similar to the controls. The experiment to determine the optimum amount of raw linseed oil in the oatmeal diet showed two effects. First, as the amount of oil was increased in the diet, the percentage of neonates that reached adulthood increased. This was primarily due to the inability of the males from treatments with low oil content to completely eclose. Larvae which fed on diets containing suboptimal oil concentrations showed high mortality rates in the larval and pupal stages. The results indicate that at or above a level of .25 ml/liter, the percentage of neonates to reach adult was comparable to the control. The second effect appeared in the emerged adults. The results showed that the addition of at least .5 ml/l of raw linseed oil in the oatmeal diet produced normal males in numbers comparable to those of the control. The percent normal males decreased as the amount of raw linseed oil decreased below this level. Adult female moths did not appear to be effected by changing levels of raw linseed oil. As the levels of oil were increased in the diet, the percentage of normal females remained the same. A level of .5 ml - 2 ml/l raw linseed oil gave results for both males and females comparable to the modified hornworm diet control.

In the experiment to determine the effect of linolenic acid, technical linolenic acid (98.5%) was added at the same levels tested in the raw linseed oil experiment. An additional treatment of .75 ml linolenic acid was added to improve the precision of linolenic acid requirements. The results indicate that levels of linolenic acid at or above .125 ml/l, the percent neonates to reach adult is comparable to the control. A level of .75 linolenic acid/l was required to produce normal adult males in numbers comparable to the control (Table 4). As before, females did not appear to be effected by the levels of oil tested. Linoleic acid was tested at the same levels as linolenic acid. At .25 ml linolenic acid/l, the percentage of neonates to reach adult was comparable to the control. The highest level of linoleic acid did not produce normal wings in the adult male; 100% of all adult males in all treatments were grossly deformed, while all of the adult males in the control were normal. As in the previous two experiments the adult females were not effected by the oil levels and all measurements were comparable to the control (Table 5).

Oils

Wheat germ diets used as controls in these tests produce normal adult males without the addition of lipids. In a third series of experiments, wheat germ oil was added to the oatmeal diet at concentrations of 1, 3, 6, 9 and 12 ml/liter; 1 ml raw linseed oil/liter was the control. Results are summarized in Table 6. This experiment showed that at or above 1 ml/l wheat germ oil, the percentage of neonates to reach adult was comparable to the control. A level of 12 ml wheat germ oil/liter was required to produce normal adult males in numbers comparable to the control.

Table 6. Growth and development of larvae on oatmeal diet with added wheat germ oil.

ml wheat germ oil/l	x Days to adult ♂	♀	% Neonate to adult	% Normal ♂	♀
1	44.5 ± 1.8	46.4 ± 2.7	79.4	0.0	89.6
3	44.5 ± 1.6	45.3 ± 2.6	96.3	2.7	82.3
6	43.9 ± 2.2	45.1 ± 2.9	91.9	32.8	80.5
9	44.7 ± 1.5	45.2 ± 2.5	83.1	72.5	71.4
12	44.1 ± 1.7	45.4 ± 2.8	80.0	98.4	70.8
Control*	44.1 ± 1.5	45.9 ± 2.6	90.0	100	93.4

* Control oatmeal diet with 1 ml raw linseed oil/liter added.

Discussion

Gypsy moth larvae reared on the oatmeal diet could not develop beyond the second larval instar without the addition of a sterol. The addition of a minimum of 250 mg/liter of cholesterol or 500 mg/liter of B-sitosterol resulted in normal larval growth and development. Sterols also seem to have some effect on developmental time and larval survival to adult. Survival to adult increased as sterol amounts were increased to 250 mg cholesterol or 500 mg B-sitosterol while developmental time adult decreased as sterol levels increased.

In the B-sitosterol test, 4.4% of the larvae survived to adult, even though no sterols were added. This may have been caused by a product change. The earlier tests were conducted using Quaker rolled oats; Purina rolled oats were used for the B-sitosterol test (Table 2).

Although wheat germ and rolled oats both contain 7-9% lipid fractions, the specific fatty acids present are different (Table 7). Since the addition of .75 ml/l linolenic acid, or .5 ml/l raw linseed oil to the oatmeal diet produced normal wings in adult males, it is probable that the larvae require linolenic acid for normal development. Linoleic acid added to the diet did not produce normal adult male insects and very high levels of wheat germ oil (12 ml/l) were required to produce normal male insects. The female larvae can grow and develop normally when supplied with much lower levels of fatty acids than needed by the males.

Table 7. Composition of lipid fraction of dietary materials.

Fatty Acid	Raw linseed oil	Wheat germ oil	Rolled oats	Wheat germ
Linolenic	52-55%	10.8%	3%	5.2%
Linoleic	19-20%	44.1%	45%	57.0%
Oleic	±15%	30%	35%	17.3%
Stearic	± 5%		17%	18.5%
Palmitic	± 5%		17%	18.5%
Myristic	± 5%		17%	18.5%

Project Number: GM 9.3.5
Project Title: Comparison and Evaluation of Rearing Techniques
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leader: O. T. Forrester

No work is being reported this period. Several rearing techniques will be reported next report period.

Project Number: JB 9.1.1
Project Title: Management of Japanese Beetle Populations in and Around Airports.
Report Period: April 1, 1979 - September 30, 1979
Report Type: Interim
Project Leader: Winfred H. McLane

On September 12, 1978, Japanese beetle quarantine regulations were amended by the U. S. Department of Agriculture to remove nursery stock, soil and sod from regulation. The only articles that will continue to be regulated under the quarantine are means of conveyance, such as aircraft, which can pose a threat of spreading the pest into uninfested states.

The Japanese beetle causes extensive damage in the Eastern States and the current regulatory program serves to prevent the artificial movement of the pest to uninfested areas. Airport environments offer excellent habitat for the Japanese beetle, and large buildup of populations are often encountered there. Effective soil larvicides are not available to check these outbreaks. Beetles of both sexes disperse out of turf areas (between runways, etc.) in search of favored host plants on which the adults feed. Consequently, large populations of adult insects may be found near terminal buildings, baggage staging areas and loading aprons. These insects may enter aircraft and be transported large distances to uninfested states. There is particular concern about the impact the Japanese beetle is expected to have in Arizona, California, Idaho, Nevada, Oregon, Utah and Washington. Therefore, aircraft departing for these states from hazardous airports in the east are treated with d-phenothrin. Treatments are applied to the baggage holds and passenger cabins. These treatments are costly, time consuming and may cause delays in aircraft departure. Furthermore, public opinion of such a treatment program is largely negative. A draft Environmental Impact Statement for this program has been prepared. It was determined that both the short and long-range program goals of halting or retarding the natural spread of the pest to western states can best be met by developing a management system which optimally integrates available chemical, biological and cultural control methods. The intent of such a program would be to stabilize populations near airports at low levels such that the need to treat aircraft to minimize hazard of spread would be precluded.

Objectives

1) Pilot test multi-component control strategies to determine the most effective means for reducing insect populations near aircraft to non-hazardous levels.

2) Develop procedures for maintaining populations at low, non-hazardous levels.

Methods

The management system could incorporate a number of components. These are listed and briefly discussed below:

1) Monitoring Population Density - Sex pheromone or food bait traps can be used to monitor temporal changes in population density. However, the trapping system is not sufficiently refined to estimate larval density from adult survey data. Estimation of population density will be necessary to determine the need for, timing of, and type of treatment. The availability of such a monitoring system would serve as an early indicator of building populations and could be implemented in all airports of concern.

2) Insecticidal Soil Treatment - Currently, no effective residual soil insecticide is available for use. Oftanol (Mobay) has given excellent grub control in small plot tests. If this compound is registered, it would be valuable in reducing larval populations to the point where adult control options become more feasible. Dursban, Diazinon, Dylox and Dasanit are also registered and may be of value if long residual action is not necessary.

3) Trap Crops - Beetles emerging from turf areas disperse in search of mates and food plants. Favored host plants (soybeans) strategically placed may intercept these dispersing insects and improve the efficacy of adult treatment. The use of trap crops may also serve to localize the following generation larvae, thus reducing the area needed to be put under grub control.

4) Foliar Spray - Materials such as Carbaryl, Malathion, Methoxychlor may be used as adulticides to treat foliage of trap crops and other host plants (ornamental) in the vicinity.

5) Herbicides - Treatment of turf areas with herbicides to reduce adult host material may augment the effectiveness of the trap crop.

6) Soil Liming - Good evidence exists that larval populations are reduced by adjusting soil pH to neutrality or slightly alkaline. Such practice may have great value in maintaining beetle populations at low levels.

7) Baited Traps - Attractant sources (sex pheromone and/or food bait) within the trap crop area will increase migration into the area and facilitate the adulticide treatment.

8) Milky Spore Disease - While this material is not sufficiently efficacious to control dense populations of grubs, augmenting the pathogen may serve to maintain low populations at non-hazardous levels.

During November, 1978, a planning meeting was held at Philadelphia, PA to plan Japanese beetle programs for eight airports. The following personnel were present:

Table 1. Personnel attending the Philadelphia Japanese beetle meeting.

Name	Organization	Location
M. Cleveland	SEA	Beltsville, MD
T. Ladd	SEA	Wooster, OH
M. KLein	SEA	Wooster, OH
K. Lawrence	SEA	Wooster, OH
J. Kennedy	APHIS	Hyattsville, MD
C. Amyx	APHIS	Hyattsville, MD
P. Ochs	APHIS	Hyattsville, MD
C. Nigro	APHIS	Moorestown, NJ
S. McNally	APHIS	Philadelphia, PA
H. Morgan	APHIS	Brentwood, TN
R. Addington	APHIS	Dulles International
R. Berninger	APHIS	Newark International
D. Baker	APHIS	Newark International
D. McCullough	APHIS	Philadelphia International
H. Mumma	APHIS	McGuire AFB, NJ
C. Overmiller	APHIS	Dover AFB, DE
P. Turner	APHIS	Columbus Airport, OH
C. Schwalbe	APHIS	Otis AFB, MA
W. McLane	APHIS	Otis AFB, MA

Various control techniques were discussed and the following program was proposed for 1979.

Table 2. Japanese Beetle Methods Development FY 1979

Activity	1	2	3	4	5	6	7	8
Population Monitoring	x	x	x	x	x	x	x	x
Soil Treatment-Oftanol	x							x
Soil Treatment-Dasanit		x						
Host Treatment-Carbaryl				x	x			x
Bait Stations			x	x	x	x	x	x
Trap Crops							x	

1. Philadelphia
2. Newark
3. Dulles
4. Dover
5. Columbus
6. McGuire
7. Baltimore
8. Cincinnati

On November 16, 1978 a proposed budget was submitted and funds were approved for work to be conducted at eight airports. Work plans based on activities in Table 2 were developed and approved for each program.

During January and February of 1979 each airport was visited and APHIS personnel and airport officials met to discuss the work to be conducted. Requests for experimental use permits for the insecticides Dasanit and Amaze were submitted to the Environmental Protection Agency by Mobay Chemical Company. Labels are attached; Dasanit (2.5 lb AI/A) carried permit 3125-EUP-161 and Amaze (2.0 lb AI/A) was permit 3125-EUP-160.

C-8734 Base Reg. (2842)

U.S. LABEL

Reason to Issue: To revise company name and "Conditions of Sale". Date of Draft: 3/29/78 (S)
Supersedes Draft Dated: 2/3/77

EPA Reg. No. 3125-213-AA

(R)
DASANIT

15% Granular

INSECTICIDE - NEMATICIDE

FOR USE ONLY BY COMMERCIAL GROWERS, APPLICATORS, AND NURSERYMEN

FOR EFFECTIVE CONTROL OF PARASITIC NEMATODES AND SOIL INSECTS ON CERTAIN CROPS, AND COMMERCIAL TURF GRASSES AND ORNAMENTALS

NET WEIGHT POUNDS

D A N G E R P O I S O N

KEEP OUT OF REACH OF CHILDREN

(See antidote and danger statements on rear panel)

ACTIVE INGREDIENT:
O,O-Diethyl O-[4-(methylsulfinyl)phenyl] phosphorothioate ≠ 15%

INERT INGREDIENTS: 85%
100%

≠U.S. Patent No. 3,042,703

EPA Reg. No. 3125-213-AA

STOP - READ THE LABEL BEFORE USE

NOT FOR USE OR STORAGE IN OR AROUND THE HOME

SOLD BY

MOBAY CHEMICAL CORPORATION
AGRICULTURAL CHEMICALS DIVISION
Box 4913, Kansas City, Mo. 64120

Note: Underlined letters in chemical nomenclature should be italicized when printed, not underlined.

Technical Information

Chemagro

®OFTANOL
(Formerly BAY SRA 12869)
Insecticide
FOR EXPERIMENTAL USE ONLY

Chemagro Agricultural Division
Mobay Chemical Corporation
Box 4913, Kansas City, Missouri 64120

INTRODUCTION

OFTANOL, formerly BAY SRA 12869 (BAY 92114), insecticide was originated by the parent company of Farbenfabriken Bayer GmbH, Leverkusen, West Germany, and is being developed in the United States and Canada by Chemagro under license. OFTANOL is protected by U.S. Patent No. 3,621,082 and Canadian Patent No. 825,198. It has been tested under ENT-27748 assigned by the Entomological Research Service of the United States Department of Agriculture.

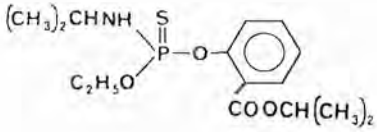
OFTANOL has demonstrated excellent potential as a soil insecticide in a number of field crops and vegetables. Its moderate toxicity to fish and earthworms is a particular benefit. OFTANOL is highly toxic to honey bees.

CHEMISTRY

Chemical Name:

1-Methylethyl 2-[[ethoxy[(1-methylethyl)amino]phosphinothioyl]-oxy] benzoate

Structural Formula:



PHYSICAL AND CHEMICAL PROPERTIES (Technical)

Appearance:	Yellow-brown liquid.	Molecular Weight:	345
Melting Point:	$< -12^{o}$ C.	Specific Gravity:	~ 1.14 @ $\frac{20^{o}}{20^{o}}$ C
Solubility:	Soluble in acetone, kerosene, alcohol, ether, benzene, and xylene. Soluble in water. ca. 20 ppm.		
Stability:	Stable under normal use conditions. Subject to hydrolysis under alkaline conditions.		

FORMULATIONS AVAILABLE FOR TESTING

OFTANOL is available for testing in the formulations listed below. It is required that the nature of a contemplated project be specified when requesting samples.

OFTANOL 6 Emulsifiable containing 6 pounds active ingredient per gallon
OFTANOL 15% Granular
OFTANOL Technical (available only for special purposes)

HANDLING AND STORAGE

Store in a cool dry area. Store the liquid formulations away from excessive heat and open flame. Store away from foods in an area designated specifically for pesticides.

OFTANOL is a Reg. TM of the Parent Company of Farbenfabriken Bayer GmbH, Leverkusen.

Original plans called for treating 1,600 acres at Philadelphia (1,460 acres by aircraft and 140 by ground equipment) and 3,000 acres at Cincinnati (2,720 acres by aircraft and 280 acres by ground equipment). Newark was to treat 700 acres with Dasanit using ground equipment only.

Using the APHIS Cessna Ag-Truck aircraft, a modified granular spreader was calibrated to apply 13.3 pounds of 15 percent granular Amaze per acre of turf. Some modifications had to be made on the spreader to allow an effective swath width of 60 feet.

Ground equipment was located and moved to the airports for spreading the two insecticides where aircraft could not be used. All ground equipment was calibrated to give the desired amount of material on each acre.

It was originally planned to begin treatment in March, however, we were not able to start aerial application of Amaze at Philadelphia and Cincinnati until early April because of delays in obtaining experimental use permits. However, at Newark turf treatments with Dasanit started the last week of March using ground equipment only.

Spring grub surveys started during Mid-March or as soon as the frost was out. Using a 7 x 7 inch shovel, one dig and count of grubs was made on each acre of turf. Soil samples were also sent to Gulfport, Mississippi for chemical analysis.

Evaluation of adult beetle populations was to be accomplished with pheromone/lure baited traps. The following table lists the number of traps deployed at each airport. All traps were in place by June 15.

Table 3. Number of Pheromone and lure baited traps used.

Airport	No. Traps
Baltimore	25
Cincinnati	100
Columbus	200
Dover	10
Dulles	1,200
McGuire	100
Newark	80
Philadelphia	150

At Dulles, we attempted to use traps to control the adult population. One trap/acre was used over 1,400 acres of turf area. Traps were located in such a way as to give best "protection" to aircraft. All traps were baited with pheromone and granular lure. Preliminary observations indicate that we were successful in controlling the adult beetle population at Dulles such that no treatment of aircraft was felt necessary. However, near the TWA facility a heavy population of beetles developed on host plants near a single trap line. As this population was very near TWA aircraft, it was sprayed with carbaryl from ground equipment.

In general all traps performed well at all locations. The pheromone was easy to use and worked well despite an error in formulation of the lure. This was rectified by adding lure to each trap a number of times throughout the summer as the material dried out after about two weeks. We also had a number of traps stolen during the season. At Greater Cincinnati airport over 2,000 pounds of beetles were trapped in 110 traps during July. A much larger number of beetles would have been captured with larger capacity traps.

Because of an unexpected buildup of Japanese beetle adults at Baltimore - Washington airport, an aerial treatment with Sevin 80S was conducted and Sevin 4-oil was applied to all turf areas at Greater Cincinnati airport during the first week of August.

On September 16, 1979, the entire airport at Columbus, Ohio was treated with the experimental insecticides Amaze (1,230 acres) and Dasanit (60 acres) to enable comparison of those compounds.

Final reports covering the work at each airport are attached.

Table - Percentage control of larvae of Japanese beetles[1] at three international airports, treated with fensulfothion[2] or Amaze[R] [3], by airplane or ground spreaders, treated Spring, 1979.

Location Treatment, how applied, date (formulation) (Rate - lb. ai/acre)	Effective days[4]	Spring Number Larvae/ft^2 Untreated Control	Spring Number Larvae/ft^2 Treated	Spring Percentage Control	Fall[5] Number larvae/ft^2 Untreated Control	Fall[5] Number larvae/ft^2 Treated	Fall[5] Percentage Control
Cincinnati							
Amaze[R] - Ground - 4/7/79 (15G. - 2 lb.) (Skibbe)	52	9.3	0.9	97	6.7	1.28	81
Amaze[R] - Ground - 4/7/79 (20G. - 2 lb.) (Skibbe)	52	12.5	0.6	96	6.2	0.94	85
Amaze[R] - Air - 4/7-8/79 (15G - 2 lb.)	52	11.9	1.1	91	4.4	0.8	82
Philadelphia							
Amaze[R] - Air - 4/15-16/79 (15G. - 2 lb.)	42	7.6	2.3	71	2.0	0	100
Amaze[R] - Ground - 4/18/79 (15G. - 2 lb.) (B. Turbine)	40	7.4	2.9	60	0.5	0	100
Newark							
Dasanit - Ground - 3/28/79 (15G. - 2.5 lb.) (Herd)	70	10.7	0.8	93	17	2.7	84
Dasanit - Ground - 4/17/79[6]	42	8.8	2.9	67	17.6	9.2	47.6

1/ 94% or more *Popillia japonica* at all locations, spring.
2/ Dasanit[R]
3/ Other designations - Oftanol[R], SRA 12869 and Bay 92114.
4/ Number days between first significant rainfall and day plots were read.
5/ Effect on next annual brood hatched from eggs laid in July and August.
6/ One plot only - very poor coverage - windy, machinery problems, etc.

Prepared by K.O. Lawrence
USDA, SEA-AR

October 26, 1979

JAPANESE BEETLE MANAGEMENT PROJECT

BWI AIRPORT 1979

The Maryland Department of Agriculture, Plant Protection Section, conducted specific surveys in cooperation with the Maryland Department of Transportation (BWIA Facilities Maintenance Staff) and the USDA, APHIS, Plant Protection and Quarantine staff in an effort to improve management techniques for Japanese beetle populations at the airport. The primary goal was to determine ways of preventing beetles from entering aircraft at loading and docking areas.

Objectives of the studies were to:

1. Determine spring and fall grub populations at the airport.

2. Determine effectiveness of a soybean/grape trap crop system in reducing the movement of adult beetles to aircraft and docking areas.

3. Determine effectiveness of traps baited with sex lures and food lures in reducing the movement of adult beetles to aircraft and docking areas.

I. Methods

A. Survey of Spring Grub Populations:

On May 3, 1979, members of the Plant Protection staff, assisted by the Turf and Seed Section staff, used a sod cutter to lift sections of sod each one foot wide and 20 feet long. Sod was cut at various depths until it was determined which depth detected the majority of the grubs present in the upper zone of soil. During sampling, all cuts were made at 1/4 to 1/2 inch below the root zone of the sod. Twenty-six sites were sampled (see Map 1 for sample sites and Table 1 for a summary of grub counts).

B. Trap Crops:

Trap crop sites were chosen at areas with low and high grub populations. On May 31, 1979, two trap crop sites (each ca. 700

sq. ft.) were planted (no-till) with York soybeans. Twenty-five grapevine plants also were planted at each trap crop site. Weekly observations were made of the numbers of adult beetles and damage levels on the soybean and grapevine plants.

C. Adult Japanese Beetle Survey:

To monitor adult Japanese beetle populations, 30 traps baited with sex lures and food lures were placed in areas with high and low grub populations and in turf areas adjacent to docking areas (see Map 2 for locations). Table 2 summarizes adult beetle catches from these traps by location

D. Pesticide Residue Analysis:

Soil samples (one quart from top four inches) were taken from six sites in areas that had been treated in the early 1960's with pesticides for Japanese beetle control and were sent to the USDA Lab at Gulfport, MS. for residue analysis. Map 3 shows the soil sample sites and refer to Table 3 for results of the residue analysis.

E. Survey of Fall Grub Populations:

A total of 80 sites were sampled for the presence of Japanese beetle grubs on September 17 and 18 (see Map 4 for locations). Garden spades were used to lift sections of sod and soil measuring 7" x 7" to a depth of 6". Soil samples were sifted through a 1/4" mesh screen onto a collecting sheet. Table 4 summarizes the number of grubs collected. All grubs were identified to species and sent live to the USDA Lab, OARDC, Wooster, OH. for pesticide resistance tests.

II. Results and Discussion

As a result of the spring grub survey it was determined that the only heavy Japanese beetle population at BWIA was located on the south side of the approach end of runway 10-Right. This area had undergone extensive site alteration subsequent to the last soil insecticide treatment at the airport. It is interesting to note that we detected no grubs from areas treated with dieldrin in the early 1960's.

Adult beetle trap catches confirmed that the area by 10-Right was the most heavily infested. Initially, traps were emptied weekly, but as the adult population peaked the traps were serviced twice a week and finally at one point, every 2 hours in an attempt to prevent them from overflowing with beetles.

Based in part upon trap catches, a portion of the airport (ca. 70 acres) was sprayed with Sevin using ground equipment on July 16, 1979. Temporary control of adults was attained. An aerial application of Sevin subsequently was applied on July 23, 1979 by USDA to all turf areas and bordering woodlands of the entire airport. The numbers of adult beetles caught post-spray were very small (less than 15 beetles per trap per day).

The soybean/grape trap crops were not successful due to extensive stands of preferred hosts such as red clover, wild grape and sassafrass growing in the area. Adult beetles also were attracted away from the soybeans and grapes by food and sex lure baits in the beetle traps. The trap crop systems would be effective in the absence of baited traps and stands of preferred hosts. However, observations at BWIA indicate adult beetle traps baited with sex lures and food lures would be more effective than the best trap crop system. The only drawback to the adult trap was the small size of the collecting container, i.e., the container filled too rapidly during peak beetle populations.

Fall grub survey samples were taken from areas where adults had been sighted. Thus, no sample was taken in the area of runway 4 or 33-left. Positive site areas are marked in yellow on Map 4 and correspond to areas infested during the spring grub survey. These areas will undoubtedly cause problems in the spring and summer of 1980. Sample sites 51-80 had a total of 5 grubs (Table 4) and, therefore, should pose little threat in the spring of 1980.

III. Recommendations

A. Monitor spring grub population in the area bounded by runway 10-Right, 15-Right and the Fox Trot taxi-way (100 samples collected from mid-May to mid-June).

B. Apply a soil insecticide (Dursban, diazinon, or ??) to the above area at the proper time for spring grub control.

C. Apply herbicides to selected portions of the above area (40 acres) to control red clover (Beetle larvae and adult preferred host).

D. Monitor summer adult population using traps baited with sex lures and food lures (20 traps).

E. Trap (control) adult beetles in heavily infested areas using traps with modified collecting containers so as to reduce service requirements.

F. Apply aerial application of Sevin, if warranted.

WFG:dw

Table 1. - Spring Japanese beetle grub survey BWIA 3 May 1979[1]

Sample	Number of Grubs	Sample	Number of Grubs	Sample	Number of Grubs
1.	20	9.	0	17.	1
2.	23	10.	0	18.	1
3.	61	11.	1	19.	1
4.	63	12.	2	20.	0
5.	50	13.	4	21.	0
6.	61	14.	3	22.	0
7.	3	15.	1	23.	0
8.	0	16.	0	24.	0

1. Sample size = 1' x 20' x Top 2" of soil.

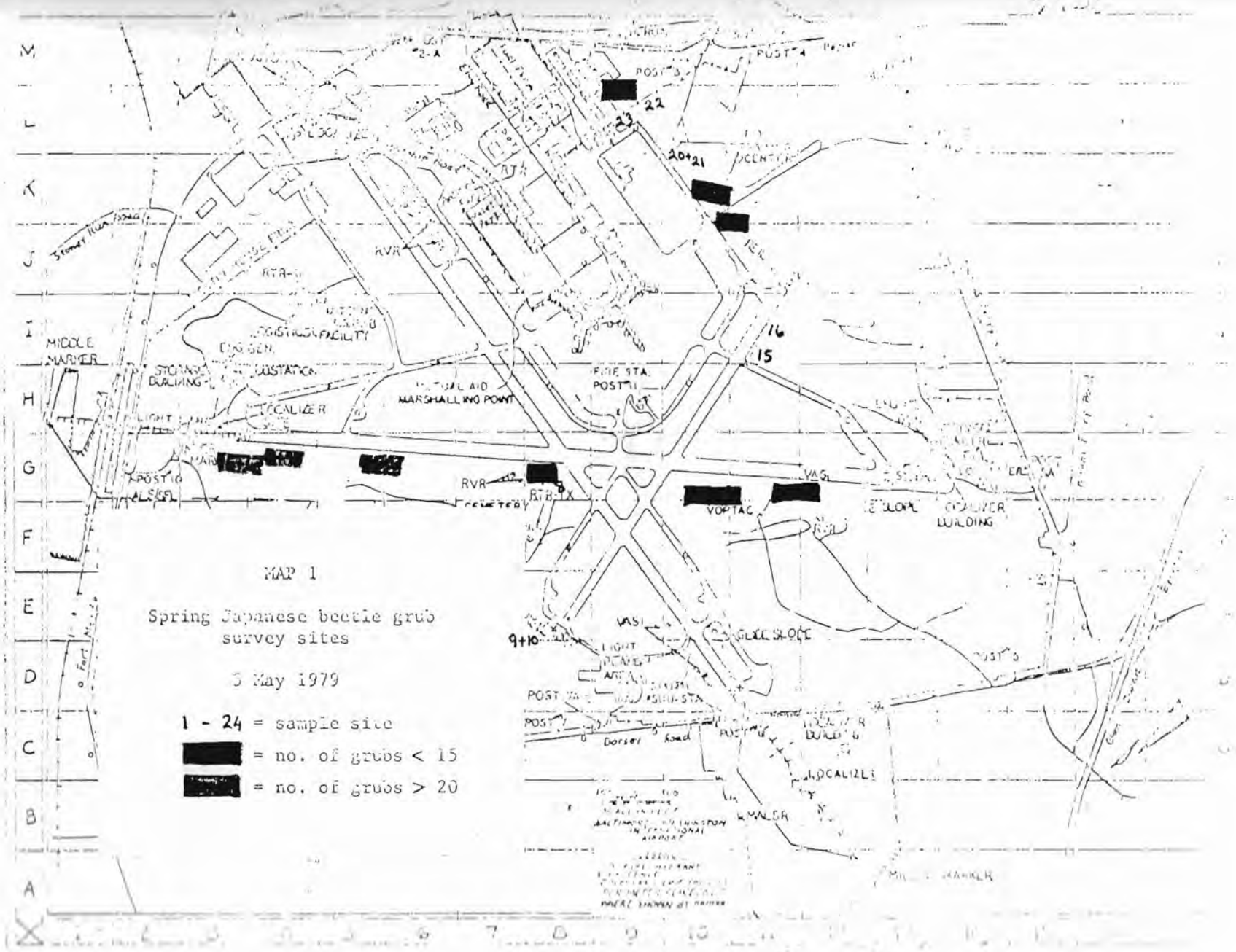
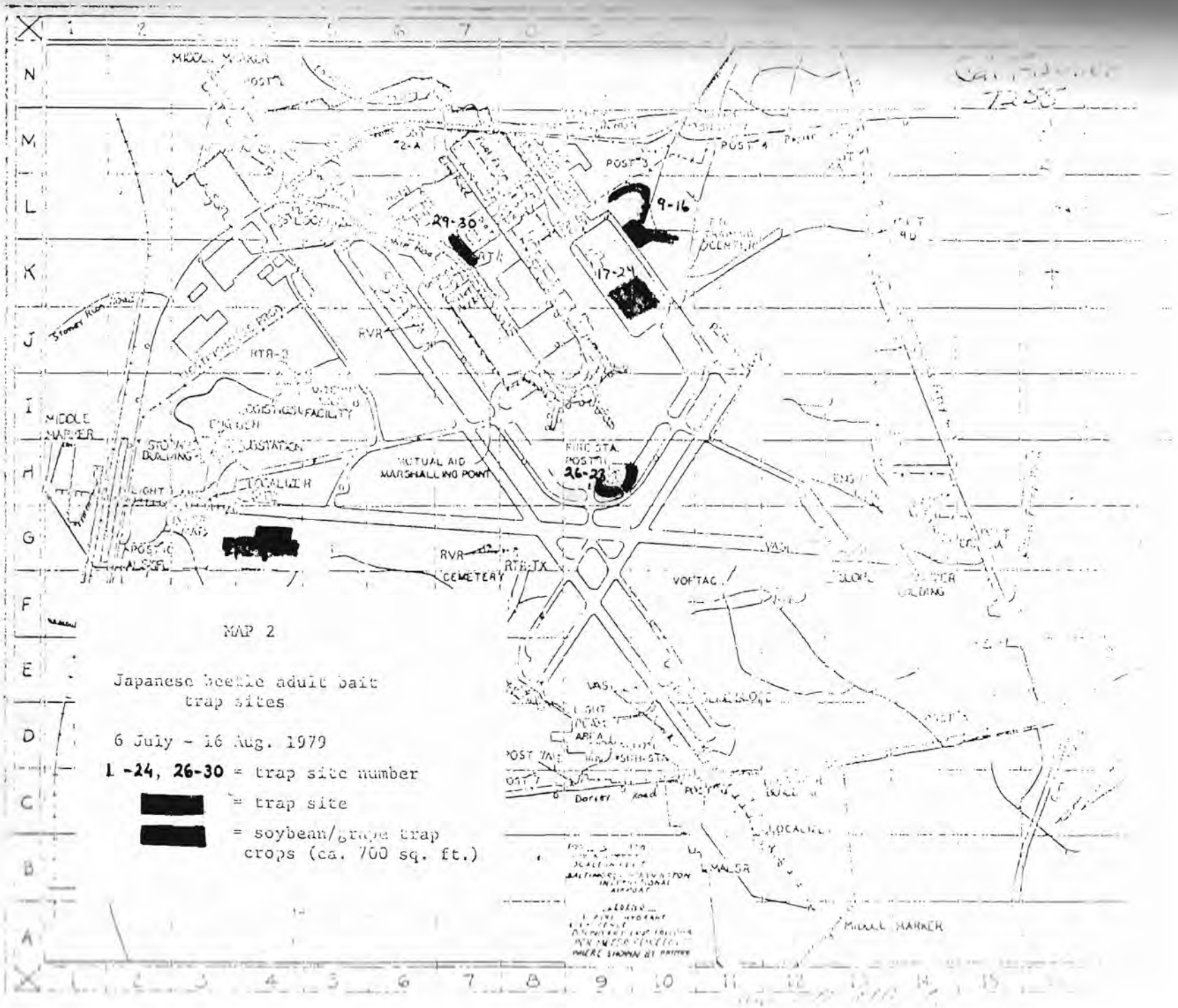

MAP 1
Spring Japanese beetle grub survey sites
3 May 1979
1 - 24 = sample site
= no. of grubs < 15
= no. of grubs > 20
MIDDLE MARKER
STORAGE BUILDING
LOCALIZER
MARSHALLING POINT
FIRE STA.
POST 11
POST 3
POST 4
POST 10
POST 5
POST 6
POST 7
POST 8
POST 9
VOPTAC
GLIDE SLOPE
LOCALIZER BUILDING
Dorsey Road
22
23
20+21
16
15
9+10

Table 2. Japanese beetle adult baited trap survey BWIA 6 July - 16 Aug 1979

Site	Beetles -by weight in grams[1]	Site	Beetles -by weight in grams[1]	Site	Beetles -by weight in grams[1]
1.	2923.2	11.	111.1	21.	373.1
2.	2735.3	12.	292.7	22.	331.8
3.	2552.0	13	270.2	23.	198
4.	2442.8	14.	170.7	24.	256.8
5.	2871.8	15.	193.7	25.	157.1
6.	2565.0	16.	357.2	26.	616.9
7.	2820.1	17.	160.4	27.	[illegible]
8.	2993.4	18.	369	28.	[illegible]
9.	375.2	19.	349.1	29.	[illegible]
10.	298.8	20.	478.4	30.	37

[1]beetles averaged 13.5 per gram



MAP 2

Japanese beetle adult bait trap sites

6 July - 16 Aug. 1979

1 -24, 26-30 = trap site number

[redacted] = trap site

[redacted] = soybean/grape trap crops (ca. 700 sq. ft.)

Table 3. Japanese beetle survey - soil samples (pesticide residue) BWIA 15 June 1979

Site No.	Amount Applied	Residue analysis in ppm					
[illegible]	30lbs/AC*	dieldrin	0.395	p,p'DDT	0.061		
		p,p'TDE	0.010	o,p'DDT	0.025		
[illegible]	30lbs/AC*	dieldrin	0.320				
[illegible]	30lbs/AC*	dieldrin	1.06	photodiel.	0.037		
		p,p'TDE	0.022	p,p'DDT	0.033		
[illegible]	30lbs/AC*	dieldrin	0.192	p,p'DDT	0.021		
		p,p'TDE	0.011				
[illegible]	30lbs/AC*	heptachlor	0.070	dieldrin	0.118	p,p'DDT	0.095
		chlordane	0.465	p,p'DDE	0.056	o,p'DDT	0.027
[illegible]	30lbs/AC*	heptachlor	0.109	dieldrin	1.59	p,p'DDT	0.039
		chlordane	0.340	photodiel.	0.029		

*treated in the early 1960's with approx. 30lbs/AC 10% granular dieldrin

MIDDLE MARKER
POST 1
SUBSTATION
NORTH SUB-STA.
POST 4
POST 3
POST 4A
POST 4B
F.D. TRAINING CENTER
RVR
RTR-D
WESTINGHOUSE PLOW
LOGISTICS FACILITY
ENG GEN
SUBSTATION
STORAGE BUILDING
LIGHT LINE
LOCALIZER
INNER MAR
POST 10
ALSF
MUTUAL AID MARSHALLING POINT
FIRE STA.
POST
RVR
CEMETERY
RTR-TX
VASI
VORTAC
LOCALIZER BUILDING
MAP 3
Soil Samples (pesticide residue)
15 June 1979
= sampling site
GLIDE SLOPE
POST 5
SUB-STA.
LOCALIZER BUILDING
LOCALIZER
MALSR
MIDDLE MARKER

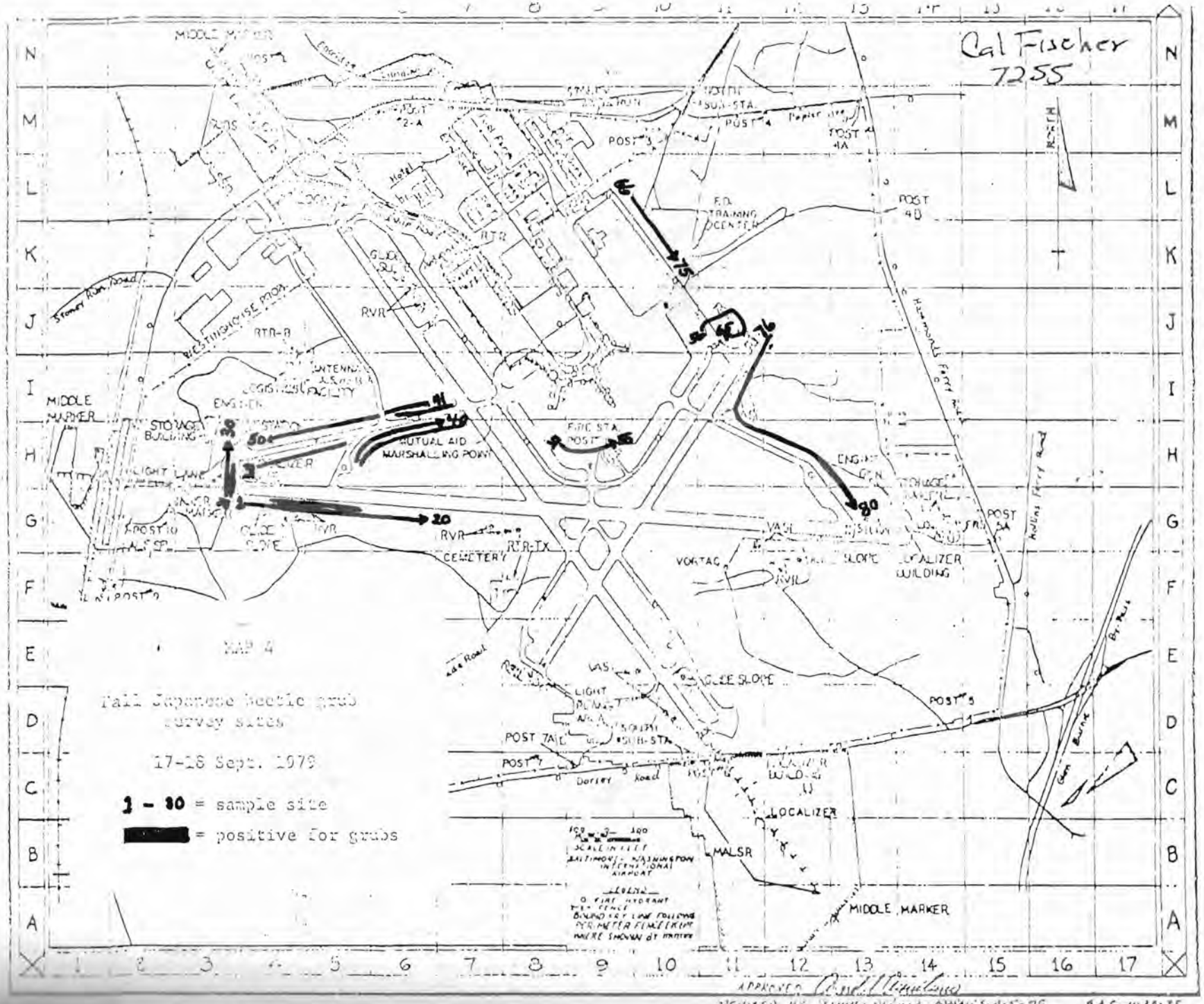

Cal Fischer
7255
MAP 4
Fall Japanese beetle grub
survey sites
17-18 Sept. 1979
1 - 80 = sample site
= positive for grubs
MIDDLE MARKER
POST 2-A
POST 3
POST 4
POST 4A
POST 4B
POST 5A
POST 7
POST 7A
POST 10
POST 11
POST 12
POST 13
POST 14
POST 15
POST 16
POST 17
POST 18
POST 19
POST 20
RTR-B
RTR-IX
RVR
STORAGE BUILDING
LIGHT LANE
MUTUAL AID MARSHALLING POINT
FIRE STA
CEMETERY
VORTAC
LOCALIZER BUILDING
LOCALIZER
MALSR
MIDDLE MARKER
Dorsey Road
Hammonds Ferry Road
Stony Run Road
Aida Road
Rail Road
Bridge
Creek
NORTH
SCALE IN FEET
BALTIMORE - WASHINGTON INTERNATIONAL AIRPORT
LEGEND
FIRE HYDRANT
FENCE
BURNED OUT LOW FOLLOWS PERIMETER FENCE KEY
WHERE SHOWN OF MATTER
APPROVED
REVISED BY
DATE
G.A.C. 11-28-78

Table 7. - Fall Japanese beetle grub survey BWIA September 17 - 18, 1979[1]

Sample	Number of Grubs	Sample	Number of Grubs	Sample	Number of Grubs	Sample	Number of Grubs
[illegible]	[illegible]	21.	1	41.	1	61.	0
[illegible]	[illegible]	22.	1	42.	1	62.	1
[illegible]	[illegible]	23.	0	43.	3	63.	2
[illegible]	[illegible]	24.	20	44.	1	64.	0
[illegible]	[illegible]	25.	0	45.	1	65.	0
[illegible]	[illegible]	26.	0	46.	4	66.	0
[illegible]	[illegible]	27.	0	47.	4	67.	0
[illegible]	[illegible]	28.	15	48.	2	68.	0
[illegible]	[illegible]	29.	3	49.	0	69.	0
[illegible]	[illegible]	30.	1	50.	0	70.	0
[illegible]	[illegible]	31.	0	51.	0	71.	0
[illegible]	[illegible]	32.	0	52.	0	72.	0
[illegible]	[illegible]	33.	0	53.	0	73.	0
[illegible]	[illegible]	34.	9	54.	0	74.	0
[illegible]	[illegible]	35.	5	55.	0	75.	0
[illegible]	[illegible]	36.	0	56.	0	76.	0
[illegible]	[illegible]	37.	0	57.	0	77.	0
[illegible]	[illegible]	38.	4	58.	0	78.	0
[illegible]	[illegible]	39.	12	59.	0	79.	0
[illegible]	[illegible]	40.	4	60.	0	80.	2

[1] Sample size = 7" x 7" x Top 6" of soil.

ANNE ARUNDEL, MD.
WASHINGTON INTERNATIONAL AIRPORT

Results of Residue Analysis Tests at Gulfport, MS

JAPANESE BEETLE

1979

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED	DATE ANALYSED	PPDDT	PPTDE	PPDDE	OPDDT	DIELDRIN	PHOTO DIELDRIN	CHLORO DANE
0001	---	SOIL	---	06-15-79	08-12-79	10-01-79	0.061	0.010	Neg.	0.025	0.395	Neg.	Neg.
0002	"	"	"	"	08-10-79	"	Neg.	Neg.	"	Neg.	0.320	"	"
0003	"	"	"	"	"	"	0.033	0.022	"	"	1.06	0.037	"
0004	"	"	"	"	"	"	0.021	0.011	"	"	0.192	"	"
0006	"	"	"	"	"	"	0.039	Neg.	"	"	1.59	0.029	0.340
0001	"	VEG.	07-24-79	07-31-79	08-10-79	11-01-79	Neg.	"	"	"	Neg.	Neg.	Neg.
0002	"	"	"	"	"	"	"	"	"	"	"	"	"
0003	"	"	"	"	"	"	"	"	"	"	"	"	"
0004	"	"	"	"	"	"	"	"	"	"	"	"	"
0005	"	"	"	"	"	"	"	"	"	"	"	"	"
0006	No Sample Arrived at Laboratory												
0001	---	SOIL	---	06-15-79	08-12-79	10-01-79	"	"	"	"	"	"	"
0002	"	"	"	"	08-10-79	10-26-79	"	"	"	"	"	"	"
0003	"	"	"	"	"	"	"	"	"	"	"	"	"
0004	"	"	"	"	"	"	"	"	"	"	"	"	"
0005	"	"	"	"	"	"	"	"	"	"	"	"	"
0006	"	"	"	"	"	"	"	"	"	"	"	"	"

JAPANESE BEETLE WORK ACCOMPLISHMENTS - FY 79

PORT COLUMBUS INTERNATIONAL AIRPORT

1. GRUB SAMPLING - Japanese Beetle grub samples were taken during May, 1979 from turf areas on airport, airport golf course and adjoining properties to determine the Japanese Beetle density in area.

a. Sampling Procedure - The area to be sampled was gridded into 5 acres blocks. One random sample (7" x 7") was taken from each of the five acre blocks and grub count recorded (See attached chart). A total of 390 samples were taken. Grub samples from airport and golf course were collected and sent to the Japanese Beetle Laboratory, Wooster, Ohio to check tolerance to pesticides. One 1/2 gallon of soil was collected from each 50 acres sampled for pesticide analysis.

2. BAIT STATIONS - 157 Elisco traps were set on the airport and golf course properties. All traps were in place by 6/15/79. The first Japanese Beetle detected in the traps was on 6/18/79. All traps were serviced on a regular basis (2-7 days) depending on the need. An area 10' radius at the base of each trap was treated with 80^{S} Sevin every 7 days if weather permitted. Approximately 1.5 million beetles were collected from traps and destroyed. All traps were pulled by 8/31/79.

3. INDIGENOUS HOST TREATMENTS: Ground treatments for adult control were made between 7/6/79 and 8/21/79 on airport and golf course properties. Adult control was limited because of above normal rainfall during July and August. Many parts of the airport were never entered with truck mounted mist blower because of the wet soil conditions. A total of 272 acres were treated with 80^{S} Sevin at one pound actual per acre.

4. SOIL TREATMENTS - On September 16, 1979, 1290.33 acres were treated with Amaze and Dasanit by air and ground equipment on airport property.

Aircraft Treatment	Amaze -	1180.45 acres
	Dasanit-	59.88 acres
Ground Treatment	Amaze -	50.00 acres

5. AIRCRAFT TREATMENTS - Port Columbus International Airport was regulated on July 4, 1979 and taken off the regulated list on August 23, 1979. Nine daily flights required inspection and/or treatment as follows:

Trans World Airlines	7	American Airlines	1
United Airlines	1		

The insecticide used in treating aircraft was 10% d-Phenothrin aerosol at the rate of 8 grams per 1000cubic feet.

Aircraft treated	196
Aircraft inspected	164
Total	360

TABLE #1 JAPANESE BEETLE SPRING GRUB COUNTS AT PORT COLUMBUS AIRPORT 1979.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
A	0	1	0	0	0	0	5	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	X	X	X	X	X	X	X	X	X	X	A
B	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	X	X	B
C	0	0	1	0	0	2	0	3	0	1	3	0	0	1	0	1	3	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	X	0	0	C
D	1	1	1	1	1	1	2	1	1	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	X	X	X	D
E	0	0	0	1	1	0	1	0	0	0	3	0	0	0	2	0	X	X	0	3	1	0	3	3	10	2	1	3	0	0	0	0	0	0	0	E
F	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	X	X	0	X	X	3	1	0	1	0	7	0	3	0	0	0	0	0	0	F
G	0	0	0	1	0	0	0	1	0	0	X	0	0	0	0	X	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	3	4	0	12	G
H	0	4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	1	0	0	4	1	7	4	3	2	H
I	1	0	5	0	0	0	0	0	0	0	1	0	0	2	2	0	2	0	0	0	0	0	0	0	0	0	3	0	1	4	0	5	7	0	X	I
J	0	0	0	0	0	1	4	0	0	2	6	1	2	0	0	0	0	0	0	3	0	0	0	1	0	0	0	1	0	2	1	3	7	X	X	J
K	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0	0	0	0	5	0	2	0	X	X	3	0	0	6	8	X	X	X	K
L	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	1	0	0	0	0	1	0	0	1	X	0	0	0	X	X	X	X	X	L
M	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0	1	1	1	0	0	0	0	0	0	X	X	X	X	X	X	X	M
N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0	0	0	0	1	1	0	2	0	X	X	X	X	X	X	0	N
O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0	0	0	0	0	O

X= NO SAMPLE TAKEN

SAMPLE = 7" X 7"

FRANKLIN, OHIO

JAPANESE BEETLE

Results of Residue Analysis Tests at Gulfport, MS

1979

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED	DATE ANALYSED	PPDDT	PPTDE	PPDDE	OPDDT	DIELDRIN	PHOTO DIELDRIN	CHLORO DANE	HE
0001	---	SOIL	---	05-01-79	05-10-79	07-02-79	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	0.144	Neg
0002	"	"	"	"	"	"	"	"	"	"	"	"	Neg.	"
0003	"	"	"	04-24-79	"	"	"	"	"	"	"	"	0.635	"
0004	"	"	"	"	"	"	"	"	"	"	"	"	Neg.	"
0005	"	"	"	04-25-79	"	"	"	"	"	"	"	"	"	"
0006	"	"	"	"	"	"	"	"	"	"	"	"	"	"
0007	"	"	"	04-26-79	"	"	"	"	"	"	"	"	"	"
0008	"	"	"	"	"	"	"	"	"	"	"	"	"	"
0009	"	"	"	"	"	"	"	"	"	"	"	"	"	"
0010	"	"	"	"	"	"	"	"	"	"	"	"	"	"
0011	"	"	"	"	"	"	"	"	"	"	"	"	"	"
0012	"	"	"	"	"	"	"	"	"	"	"	"	"	"
0013	"	"	"	"	"	"	"	"	"	"	"	"	0.073	"
0014	"	"	"	"	"	"	"	"	"	"	"	"	Neg.	"
0015	"	"	"	"	"	"	"	"	"	"	"	"	"	"
0016	"	"	"	04-27-79	"	"	"	"	0.018	"	"	"	"	"
0017	"	"	"	"	"	"	"	"	Neg.	"	"	"	"	"
0018	"	"	"	"	"	"	"	"	"	"	"	"	0.041	"
0019	"	"	"	04-30-79	"	06-29-79	"	"	"	"	"	"	Neg.	"
0020	"	"	"	05-01-79	05-10-79	"	"	"	"	"	"	"	"	"
0021	"	"	"	05-02-79	"	"	"	"	"	"	"	"	"	"
0022	"	"	"	05-01-79	"	"	"	"	"	"	"	"	"	"
0023	"	"	"	"	"	"	"	"	"	"	"	"	"	"

U.S. DEPARTMENT OF AGRICULTURE

Memorandum

ANIMAL AND PLANT HEALTH INSPECTION SERVICE
Plant Protection and Quarantine Programs
P.O. Box 17134
Dulles International Airport
Washington, D.C. 20041

SUBJECT: JB 9.1.1C Dulles -- Oct. 1, 1978-Sept. 30, 1979

DATE: 10/06/79

TO: Dwaine Russell, District Director

For the first time since 1975 Dulles International Airport Was not regulated for Japanese Beetles. The lure & pheromone baited traps at one (1) per acre on maintained turf for a total of 1400 traps were apparently successful in reducing the flight activity of the beetles near aircraft and the jet ramp. Specifically, we achieved the following objectives:

A. Monitored Spring & Fall Grub Population (1 site/5 acres)

Spring					Fall				
254	Sites	X	Ø	Larvae = 0	233	sites	X	Ø	Larvae = 0
16	"	X	1	" = 16	9	"	X	1	" = 0
6	"	X	2	" = 12	16	"	X	2	" = 32
2	"	X	3	" = 6	8	"	X	3	" = 24
1	"	X	4	" = 4	5	"	X	4	" = 20
1	"	X	5	" = 5	3	"	X	5	" = 15
					3	"	X	6	" = 18
					1	"	X	7	" = 7
					1	"	X	8	" = 8
					1	"	X	10	" = 10
280	sites			= 43	280	sites			= 143

Most of the grubs found in the spring survey were from good turf in well drained locations. The Japanese Beetle Lab. determined that 70% of a sample of grubs that we submitted for pesticide resistance studies were Cyclocephala. From the fall survey all of a small sample of grubs were locally determined to be Cyclocephala and not Popillia. Grub mortality will probably be highest in the runway areas where the soils are shallow and the turf not vigorous.

B. Established relationship between spring and fall grub counts and adult beetles captured in traps.

The largest numbers of beetles were collected from areas where grubs were found in the spring and fall surveys. Large numbers of beetles were also collected from the 1st., row of traps located west of the runways. We captured about 100% more beetles from these traps than from any other of the three adjacent rows of traps. We collected 5,443,800 beetles from all areas.

C. Tested the effectiveness of Elisco Japanese beetle traps baited with lure & pheromone.

The Elisco Japanese beetle traps probably made the difference with the result that Dulles was not regulated for Japanese Beetles in 1979. The adult beetle population was comparable to that of 1978 when Dulles was regulated.

The granular lure at 3-4 tsp. per baiting worked well but dried out quickly and was not very effective after 2 weeks. Some lure placed in perforated plastic cups was less subject to weathering and was effective much longer.

Rebaiting began July 23, 1979 and was completed Aug. 2, 1979. This coincided with a critical time for collecting beetles with the result that some traps overflowed which resulted in an increase in the beetle pressure on the jet ramp area.

At active traps numerous beetles would congregate at the cap under which the pheromone was placed. The pheromone may be more effective if placed under the lure holder where the beetles would more readily fall into the cage.

D. Made a determination as to how effective the program was in detering the flight of Japanese beetles in and around aircraft and docking areas.

During the early and late part of the season the program was very successful. (See Attachment 1). Sufficiently large numbers of beetles were collected so no pressure was placed on the ramp area. Some problems were encountered at midseason when beetles started to move in from the areas to the south of the jet ramp and from the eastern end of runway 30.

Some components of a Japanese beetle management system were already present. (See Attachment 2). Chlordane treatments were applied in 1975 and 1976 and milky spore in 1971, 1972 and 1975. With the addition of the traps flight activity around the airplanes, already reduced by chemical and biological means, was further reduced. The 1975 chlordane treatment at 8 lbs actual/acre was very effective. This coincided with the area of lightest infestation. The 1976 treatment at 5 lbs actual/acre was less effective. The results of the milky spore treatments were difficult to determine. Dulles is surrounded for most part by a wide buffer zone of trees so few beetles were imported from outside the airport's boundaries.

METHODS

A. Spring Larval Survey & Soil Sampling

The larval survey on 1400 acres of turf began on March 12, 1979 and was completed April 20, 1979. One (1) sample (7x7x6") was taken from each 5 acres for a total of 280 samples. All grub counts were recorded .

One (1) quart of soil was taken from each 20 acres of turf for a total of 70 soil samples for chemical analysis. To aid in getting the correct depth with the spade the top portion of the blade was spray-painted white.

B. Establishment & Maintenance of Survey Traps

Establishment of the traps (at 1 per acre for a total of 1400) began May 21, 1979 and was completed June 15, 1979. Three L/A's were used -- 2 set up rods and one put on the cages. To obtain the correct distance

between traps we used a 209ft. nylon cord with a metal ring attached on each end. Rodsman #1 would take one end of the cord, place the metal ring over the rod and hammer his rod in place. Meanwhile, rodsman #2 would procede to the next location, down the row, stretch the cord, place the ring over the rod, and hammer the rod in place. Likewise rodsman #1 would continue down the row to position #3 and so on until one row was completed, as for example an unbroken row along the outer edge of a runway. The immediate placement of the yellow cages on the rods aided in getting straight rows. Adjacent rows of traps were set using mowing strips generally visible to obtain parallel rows. Traps in the adjacent row were set by line of sight with the established row of traps and by using the runways expansion joints as an aid to achieve the correct spacing. Once these two (2) rows were established it was easier to set additional parallel rows.

The cages should be secured to the rods with twine otherwise thundershowers will blow large numbers of the cages off the rods. Facing the top end of the rod toward the west also aids in keeping the cages from blowing off.

The beetles were collected from the traps and dumped into 30 gallon plastic bags (See Attachments 3/4). At the disposal site the bags containing the beetles were treated with the insecticide, d-phenothrin. The bags were later buried in a trench at the disposal side provided by FAA personnel. It took about 1½-2 days to service each work area, i.e. 1R, 1L, C & 30 (See Attachment Maps). In the runway area we used a portable transceiver radio to advise the tower of our movements. Removal of traps began on August 17, 1979 and was completed September 5, 1979.

C. Fall Larval Survey

The fall larval survey began on September 10, 1979 and was completed September 21, 1979. The larval population increased from 43 to 143. However, we locally determined that all of a small sample of grubs were Cyclocephala.

COSTS

A. Personal Services & Benefits (1) Spring Larval & Soil Survey Mar.12-Apr. 20, 1

GS 3/1	-	100 hrs. x $4.26/hr.	= $426.00
		OFFICER	
GS 9	-	61 hrs. x 10.20/hr.	= 622.20
		161 Subtotal:	$1,048.20

(2.) Establishment, Maintenance & Removal Survey Traps

A. Establishment -- May 21, 1979 - June 15, 1979

GS 3/1 - 145 hrs.	x 4.26/hr.	= 617.70
GS 3/1 - 150 hrs	x 4.26/hr.	= 639.00
GS 3/1 - 40 hrs	x 4.26/hr.	= 170.40
GS 2/1 - 54 hrs	x 3.56/hr.	= 192.24

OFFICER

GS-9 - 48 hrs. x 10.20/hr. = 489.60

Subtotal: 437 hrs 2,108.94

(B) Baiting -- June 18-27, 1979 & July 23-August 2, 1979

GS 3/1 - 100 hrs x 4.26/hr = 426.00
GS 3/1 - 100 hrs x 4.26/hr = 426.00
GS 2/1 - 67 hrs x 3.56/hr = 238.52

OFFICER

GS 9 - 5 hrs x 10.20/hr = 51.00

Subtotal: 272 hrs 1,141.52

(C) Removal Survey Traps -- August 17, 1979 - Sept. 5, 1979

GS 3/1 - 39 hrs x 4.26/hr = 166.14
GS 3/1 - 27 hrs x 4.26/hr = 115.02
GS 3/1 - 85 hrs x 4.26/hr = 362.10
GS 2/1 - 8 hrs x 3.56/hr = 28.48

Total 159 3,922.20

3. Fall Larval Survey -- September 9, 1979 - September 21, 1979

GS 3/1 - 75 hrs. x 4.26/hr = 319.50

OFFICER

GS 9 - 4 hrs x 10.20/hr = 40.80

Subtotal 79 360.30

4. Visual Observance of Beetle Activity -- June 15, 1979 - August 15, 1979 (mostly June 28, 1979 - July 12, 1979)

GS 3/1 - 76 hrs. x 4.26/hr = 323.76
GS 3/1 - 78 hrs. x 4.26/hr = 332.28
GS 2/1 - 78 hrs. x 3.56/hr = 277.68

OFFICER

GS 9 - 12 hrs x 10.30/hr = 122.40

Subtotal 244 1,056.12

5. Collection & Disposal of Adult Beetles -- Jul 13 - Aug 16, 1979

GS 3/1 - 156 hrs x 4.26/hr = 664.56
GS 3/1 - 171 hrs x 4.26/hr = 728.46
GS 2/1 - 116 hrs x 3.56/hr = 412.96

OFFICER

GS 9 - 12 hrs x 10.20/hr = 122.40

Subtotal 455 1,928.38

Personal Services & Benefits

Total:	L/A	1665 hrs	-	$6,866.80
	Officer	142		1,448.40
		1807 hrs		$8,315.20

B. Supplies & Equipment, etc.

1.	Elisco traps	1,200@ 5.90	=	7,080.00
2.	Trap rods	1,200@ 1.55	=	1,860.00
3.	Lure (PEP)	1,450@ 2.45	=	3,552.50
4.	Pheromone	1,450@ 1.25	=	1,812.50
5.	Backpack Sprayer (Solo)	82.95@ (2)	=	165.90
	Extension tubes	8.95@ (2)	=	17.90
	Adjustable nozzles	6.90@ (2)	=	13.80
6.	Hammer		=	9.30
7.	Shovel		=	5.55
8.	Dishpan		=	4.70
9.	Spades (2)		=	20.00
10.	1 ctn. (100 ice cream containers		=	16.68
11.	Plastic Bags (30 gal.), 200 bags GSA 8105-00-989-2376			28.48
12	Miscellaneous -- 10 bottles isopropyl alc., 1-4 lb. hammer, nylon cord, 2 pliers, 4 steel rings, 1 cooler, 2 ice trays, 2 rolls of wire, rubber bands, plastic ties, plastic cups			55.91
13.	Service station tickets			367.49
		Subtotal		$15,010.71

C. Travel Vouchers & Transportation	
D. Communications	30.00 est.
E. Vehicle & Equipment Repairs	
F. Soil Analysis (70 samples @55.00	3850.00
TOTAL COST OF PROGRAM:	$27,205.91

Observations & Recommendations

I recommend that we not place traps inside the runway-taxiway area but in parallel rows on each side. The placement and servicing of traps in this area exposes our crew to noise and air pollution and poses some safety problems. Also, collecting beetles from this area takes more time since it must be covered on foot. Vehicles are not permitted here by the FAA. I would remove the existing 3 rows of traps and place the traps from 2 of the 3 rows on the west side of the runway where the traps would then be 70 ft. apart (traps are now 209 ft. apart). Likewise, the traps from the remaining row would be integrated into a row of traps 100ft. apart on the east side of the runway.

Add 4 rows of traps (or 80 traps) to supplement the 2 rows of traps that run parallel to the southern edge of the jet ramp. These traps would be located in an area of weeds, small trees and shrubs and host plants of Rubus, Oenothera and Rosa. I would spray with Sevin host plants that are within 1000 ft. of the jet ramp. Backpack sprayers and Sevin are available to do this job.

The area to the southwest of the jet ramp needs special attention since the beetles drift in on prevailing southwesterly winds. Traps located to the southwest and within 4000 ft. of the jet ramp and including the eastern end of runway 30 should be collected more frequently.

I would double the concentration of traps in 2 areas of heavier infestation. This would involve 80 acres on runway 30 (east end) and 30 acres on 1R (north end). In lieu of the above treat these areas with a larvacide.

Leave one (1) row of traps on the western side of the runways until after September 1st and treat under these traps with milky spore.

One aerial spraying applied about 5 days to 1 week before the expected peak beetle activity and applied only to the non-maintained runway margins would probably insure success with a trapping program the next season.

To aid in getting accurate adult beetle counts each hole in the side of the cages represented 110 beetles and a full container 3,500 beetles.

To avoid vandalism and theft place traps no closer than 100 ft. from roadways, parking lots and walks.

SUPPLIES ON HAND

1,295 traps
18 boxes lure (48 cans to a box) = 864

R.J. Addington

R.J. Addington
Project Leader

cc: Win Mclane
cc: Mary L. Neal

CHRONOLOGY

VISUAL OBSERVATIONS & EVENTS

06/21 - First beetles observed
07/12 - FAA sprays plum trees at Airport entrance
07/13 - Beetles collected from traps for first time

07/19 - 1 live beetle, TW ramp
07/20 - 3 live beetles, Tw ramp 7
2 live beetles, UAL ramp 17
2 live beetles, Cont'l ramp 29

07/23 - Rebaiting begins/heavy infestation observed on lespedeza on runway margins

07/29 - 1 live beetle, EA ramp

07/31 - Beetles becoming problem near TW. Additional traps moved to the area
08/02 - Rebaiting completed

08/06 - Collections from traps & feeding declining in brambles near TW

08/07 - 1 live, TW ramp

08/07 - 1 live beetle collected off TW 63 at SFO

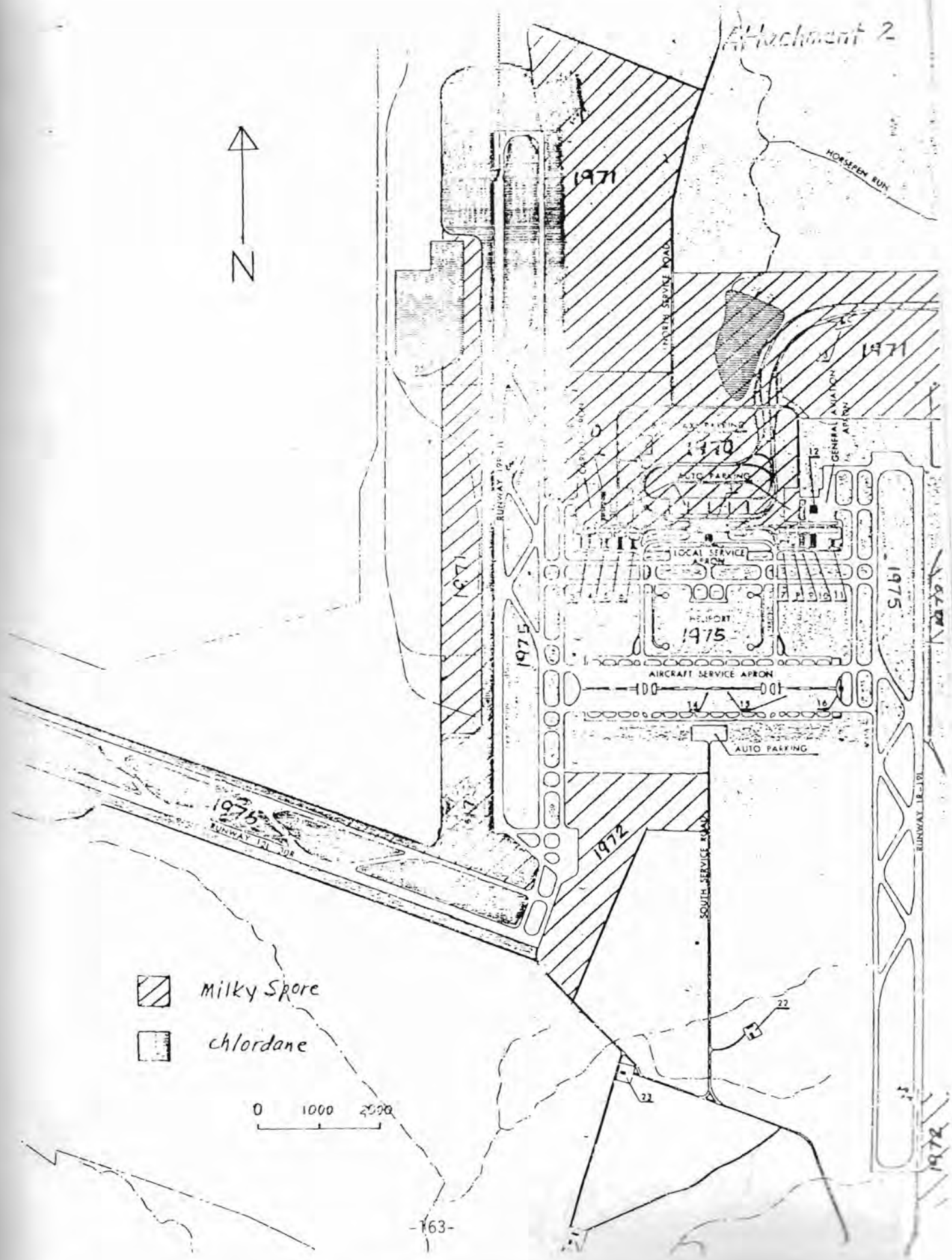
08/08 - 3 Gal. of Sevin spray applied to Rubus & Oenothera near TW

08/10 - Feeding on lespedeza down sharply

08/10 - 1 live beetle in galley of AA #55 at San Diego

08/28 - Light infestation of beetles on Lespedeza & Oenothera

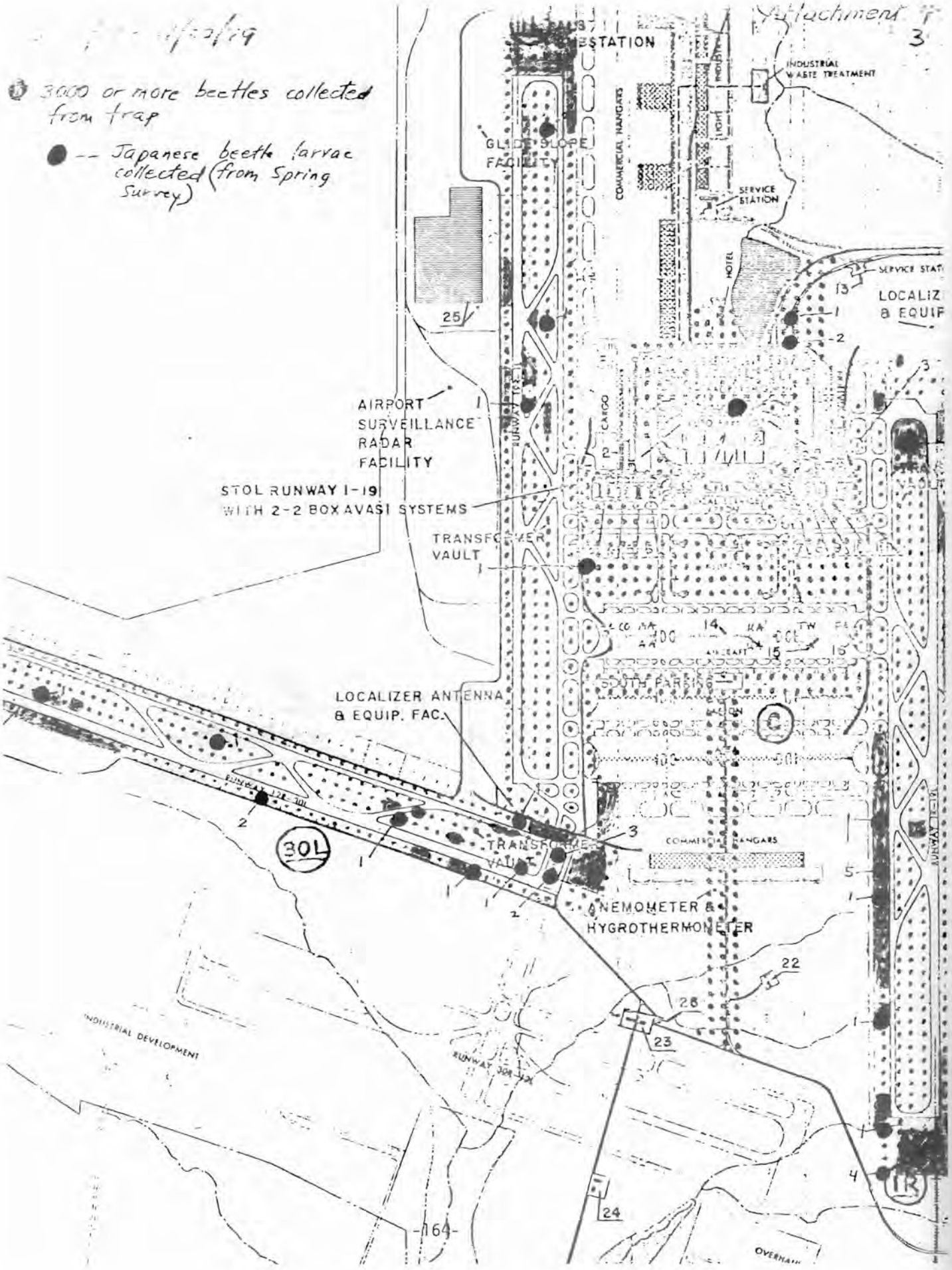
Attachment 2



Attachment 3

3000 or more beetles collected from trap

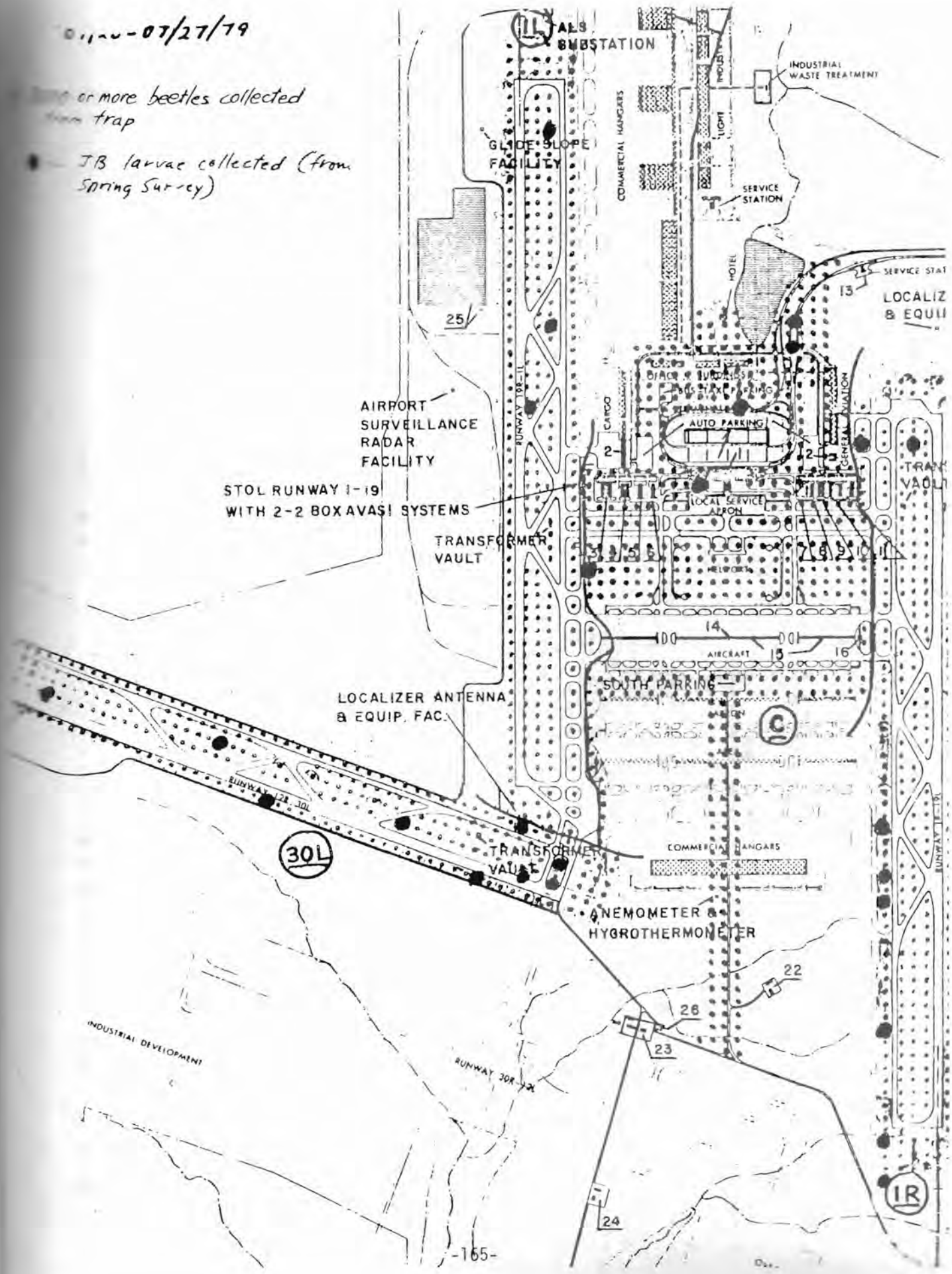
-- Japanese beetle larvae collected (from Spring Survey)

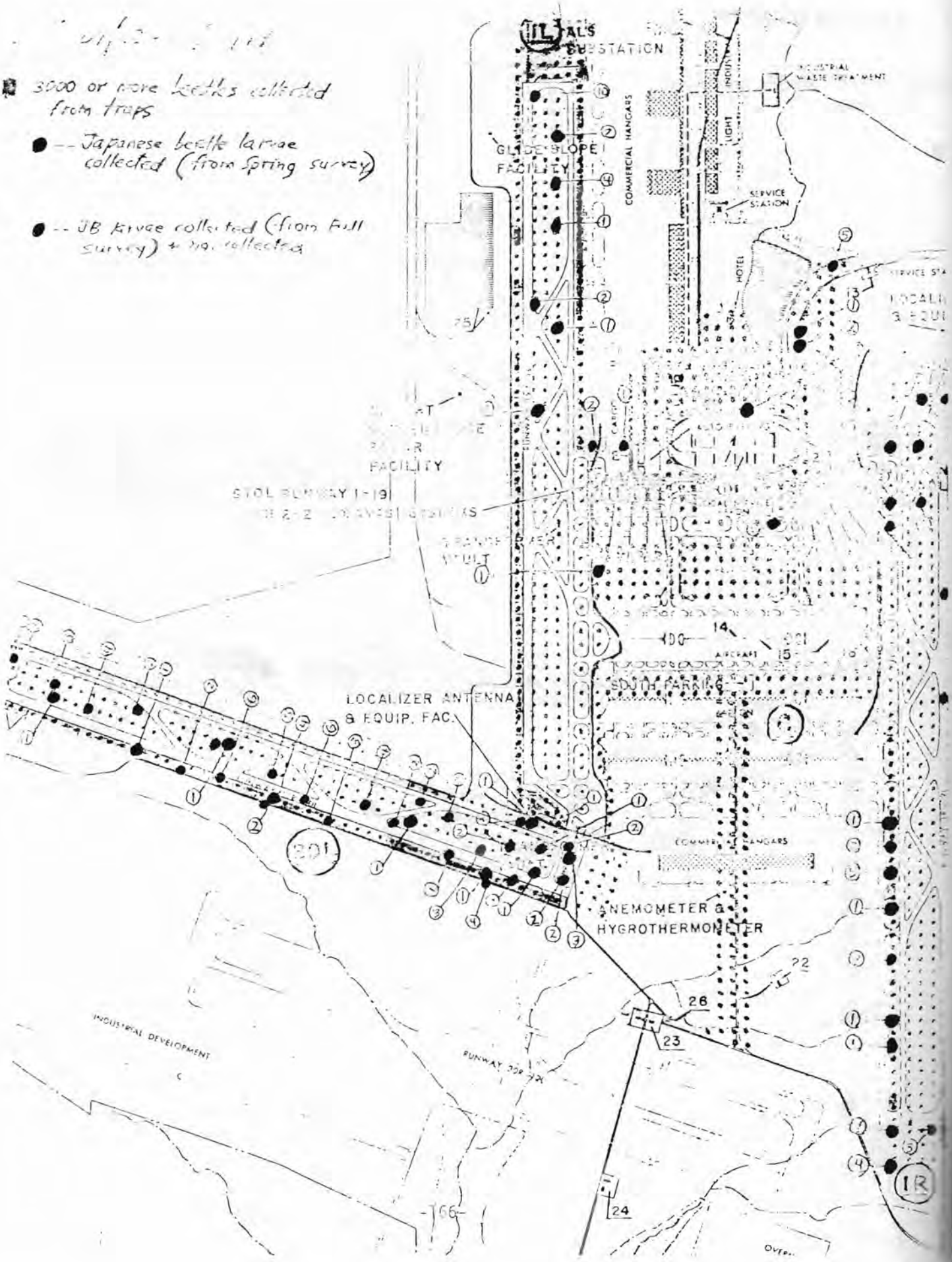


01,20-07/27/79

[illegible] or more beetles collected from trap

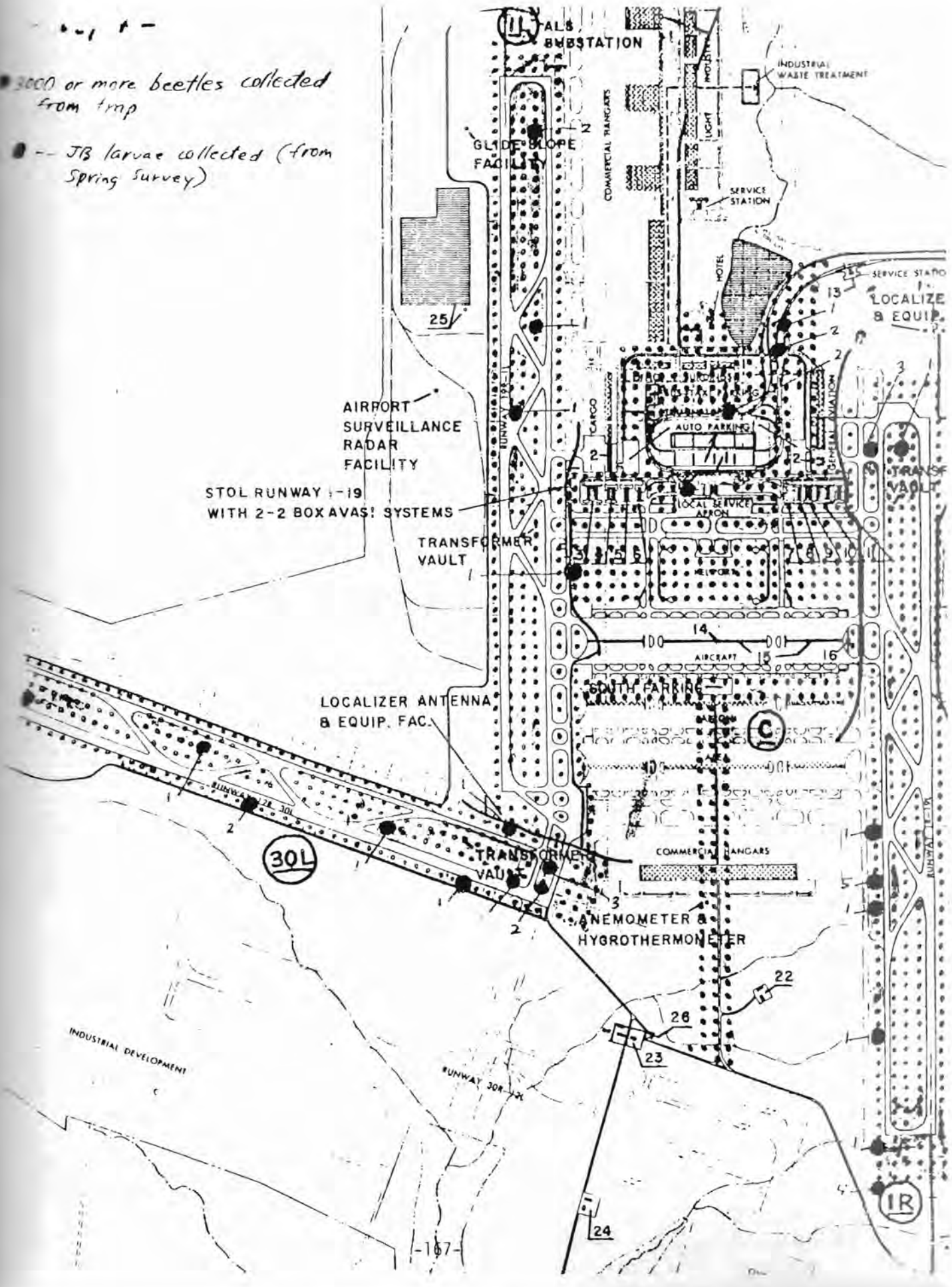
● — JB larvae collected (from Spring Survey)

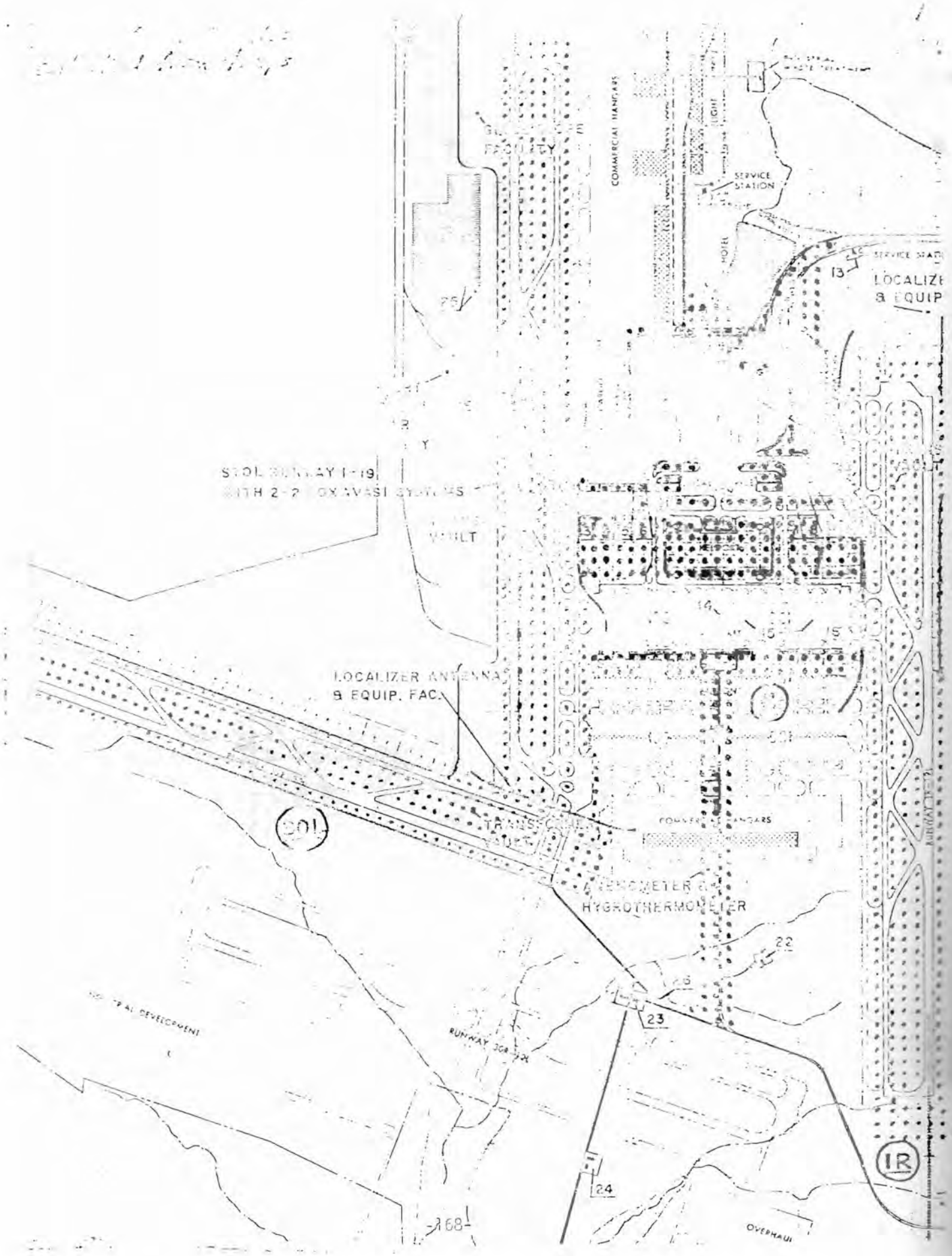



3000 or more beetles collected from traps
-- Japanese beetle larvae collected (from Spring survey)
-- JB larvae collected (from Fall survey) & no. collected
SUBSTATION
INDUSTRIAL WASTE TREATMENT
GLIDE SLOPE FACILITY
COMMERCIAL HANGARS
SERVICE STATION
HOTEL
FACILITY
STOL RUNWAY 1-19
LOCALIZER ANTENNA & EQUIP. FAC.
SOUTH PARKING
ANEMOMETER & HYGROTHERMOMETER
INDUSTRIAL DEVELOPMENT
RUNWAY 30R-12L
22
23
24
26

● 3000 or more beetles collected from trap

● -- JB larvae collected (from Spring Survey)




COMMERCIAL HANGARS
SERVICE STATION
HOTEL
13
LOCALIZE
& EQUIP
14
15
15
LOCALIZER ANTENNA
& EQUIP. FAC.
TRANSCEIVER
HYGROTHERMOMETER
22
23
24
RUNWAY
OVERHAUL
1R

Sandeen,

JAPANESE BEETLE

1979

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED	DATE ANALYSED	PPDDT	PPTDE	PPDDE	DIELDRIN	PHOTO DIELDRIN	CHLORO-DANE
0001	DAY 0	SOIL	03-28-79	03-28-79	04-09-79	06-13-79	NEG.	NEG.	NEG.	NEG.	NEG.	NEG.
0002	"	"	"	"	"	"	"	"	"	"	"	"
0003	"	"	"	"	"	"	"	"	"	"	"	"
0004	"	"	"	"	"	"	"	"	"	"	"	"
0005	"	"	"	"	"	"	"	"	"	"	"	0.342
0006	"	"	"	"	"	"	"	"	"	"	"	0.297
0007	"	"	"	"	"	"	"	"	"	"	"	NEG.
0008	"	"	03-27-79	03-27-79	"	"	"	"	"	"	"	0.115
0009	"	"	"	"	"	"	"	"	"	"	"	1.38
0010	"	"	03-17-79	03-17-79	"	"	"	"	"	"	"	NEG.
0011	"	"	03-28-79	03-28-79	"	"	"	"	"		"	"
0012	"	"	03-22-79	03-22-79	"	"	"	"	"	0.080	"	0.484
0013	"	"	"	"	"	"	"	"	"	0.164	0.016	NEG.
0014	"	"	03-26-79	03-26-79	"	"	"	"	"	0.288	0.008	"
0015	"	"	"	"	"	"	"	"	"	0.025	NEG.	"
0016	"	"	"	"	"	"	"	"	"	0.108	"	"
0017	"	"	"	"	"	"	"	"	"	NEG.	"	"
0018	"	"	03-27-79	03-27-79	"	"	"	"	"	"	"	"
0019	"	"	03-28-79	03-28-79	"	"	"	"	"	"	"	"
0020	"	"	03-16-79	03-16-79	"	"	"	"	"	0.104	"	"
0021	"	"	"	"	"	"	"	"	"	0.472	0.040	"
0022	"	"	"	"	"	"	"	"	"	0.170	0.045	"
0023	"	"	03-26-79	03-26-79	"	"	"	"	"	0.368	NEG.	"
0024	"	"	"	"	"	"	"	"	"	NEG.	"	0.212
0025	"	"	"	"	"	"	"	"	"	0.109	0.008	NEG.
0026	"	"	"	"	"	"	"	"	"	0.348	NEG.	"
0027	"	"	03-27-79	03-27-79	"	"	0.034	"	"	0.444	0.030	
0028	"	"	"	"	"	"	0.026	"	"	0.622	0.050	"
0029	"	"	"	"	"	"	0.020	"	"	0.107	0.040	"
0030	"	"	"	"	"	"	NEG.	"	"	0.557	0.068	"
0031	"	"	"	"	"	"	"	"	"	0.685	0.117	"

Landau

JAPANESE BEETLE

1979

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED	DATE ANALYSED	PPDDT	PPTDE	PPDDE	DIELDRIN	PHOTO DIELDRIN	CHLORO-DANE	HEI
0032	DAY 0	SOIL	03-27-79	03-27-79	04-09-79	06-22-79	NEG.	NEG.	NEG.	0.149	NEG.	NEG.	
0033	"	"	"	"	"	"	"	"	"	NEG.	"	"	
0034	"	"	03-13-79	03-13-79	"	"	"	"	"	"	"	"	
0035	"	"	"	"	"	"	"	"	"	0.066	"	"	
0036	"	"	"	"	"	"	"	"	"	NEG.	"	0.090	
0037	"	"	03-29-79	03-29-79	"	"	"	"	"	"	"	NEG.	
0038	"	"	03-13-79	03-13-79	"	"	"	"	"	"	"	"	
0039	"	"	"	"	"	"	0.166	"	"	0.121	"	0.230	
0040	"	"	"	"	"	"	NEG.	"	"	0.039	"	NEG.	
0041	"	"	03-16-79	03-16-79	"	"	"	"	"	0.259	.035	0.055	
0042	"	"	03-13-79	03-13-79	"	"	"	"	"	NEG.	NEG.	NEG.	
0043	"	"	03-12-79	03-12-79	"	"	"	"	"	"	"	"	
0044	"	"	04-06-79	04-06-79	04-16-79-	06-22-79	"	"	"	"	"	1.05	0.
0045	"	"	03-14-79	03-14-79	04-09-79	"	"	0.034	"	0.538	Trace	NEG.	
0046	"	"	"	"	"	"	"	NEG.	"	0.144	.027	"	
0047	"	"	03-12-79	03-12-79	"	"	"	"	0.006	0.008	NEG.	"	
0048	"	"	"	"	"	"	0.041	"	0.041	0.021	"	0.111	
0049	"	"	"	"	"	"	NEG.	"	NEG.	1.81	.262	NEG.	
0050	"	"	03-14-79	03-14-79	"	"	"	"	"	0.143	NEG.	"	
0051	"	"	03-29-79	03-29-79	"	"	"	"	"	0.590	"	"	
0052	"	"	03-12-79	03-12-79	"	"	"	"	"	NEG.	"	0.184	
0053	"	"	03-13-79	03-13-79	"	"	"	"	"	"	"	0.320	
0054	"	"	03-14-79	03-14-79	"	"	"	"	"	0.084	"	NEG.	
0055	"	"	"	"	"	"	"	"	"	0.065	"	"	
0056	"	"	03-30-79	03-30-79	"	"	"	"	"	1.46	.197	NEG.	
0057	"	"	"	"	"	"	"	"	"	0.100	0.133	"	
0058	"	"	"	"	"	"	"	"	"	0.012	NEG.	0.052	
0059	"	"	"	"	"	"	"	"	"	0.154	.180	NEG.	
0060	"	"	"	"	"	"	"	"	"	1.48	.321	"	
0061	"	"	"	"	"	"	"	"	"	0.724	.163	"	
0062	"	"	"	"	"	"	"	"	"	1.25	.134	"	

sudan

JAPANESE BEETLE

1979

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED	DATE ANALYSED	PPDDT	PPTDE	PPDDE	OPDDT	DIELDRIN	PHOTO DIELDRIN	CHLORO DANE H
0063	---	SOIL	03-30-79	03-30-79	04-09-79	07-02-79	Neg.	Neg.	Neg.	Neg.	0.302	0.139	
0064	"	"	"	"	"	"	0.032	"	"	"	0.295	0.030	
0065	"	"	"	"	"	"	"	"	"	"	0.828	0.070	
0066	"	"	04-06-79	04-06-79	04-16-79	"	"	"	"	"	0.508	0.062	
0067	"	"	"	"	"	"	"	"	"	"	0.155	Neg.	
0068	"	"	"	"	"	"	"	"	"	"	Neg.	"	
0069	"	"	"	"	"	"	"	"	"	"	0.022	"	
0070	"	"	"	"	"	"	"	"	"	"	0.070	"	

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE PROGRAMS
P.O. Box 16073
MCGuire A.F.B., N.J. 08641

October 26, 1979

JB 9.1.1F

TITLE: Management of Japanese Beetle (JB) Population in and Around McGuire AFB, N.J. with Bait Stations and Selective foliage applications of Sevin.

INTRODUCTION: A study of the JB population and the effect of 679 bait stations and selective foliage treatments with Sevin was conducted at McGuire during the 1979 adult flight period. Part of the objective was to develope a JB management system which would integrate available chemical, biological, and cultural methods to meet the short and long-range program goals of halting or retarding the artificial and natural spread of JB to the western states and foreign countries by aircraft from McGuire AFB.

Methods:

1- Larval Survey -

A) During November, 1978, and January, 1979, a special larval survey was conducted to determine JB resistance to chlorinated hydrocarbons. One hundred JB grubs were collected each time from 3 sites on McGuire and Fort Dix. These grubs were sent to the SEA, Wooster research facility for resistance determination. The JB larva from MCguire were able to survive chlorinated hydrocarbons under lab conditions at the rate of 600 pounds per acre. (See attachment #1).

B) A spring JB larval survey was conducted during April and May 1979. McGuire AFB, host locations and adjacent locations on Fort Dix were divided into 53 blocks of approximately 50 acres each. Ten (7 X 7 in) sample counts of grubs were made in each of the 53 blocks. (See attachment #2). A soil sample was collected at each sample site and sent to Gulfport for residual chemical analysis. No data available at this time.

C) A fall JB larval survey was started in mid-September, 1979. JB grub counts (7 X 7 in) were made at approximately the same sites as the Spring counts. (See attachment #3). Man-power was not available to sample all of the Spring sites.

2. TREATMENT

A) Bait stations (traps) were divided into two groupings, 1) general detection, 2) research and development(R&D). There were 579 bait stations used in the detection survey and 100 used for the R&D survey. The 579 detection bait stations were divided into 15 groupings of traps (designated on charts by letters A through O) on McGuire surrounding the aircraft parking and loading areas. All traps were at least 600 feet from the aircraft parking areas. The traps were in place by June 19.

All traps were baited with Pheromone and PEP liquid lure in bottles with cotton dental wicks.

The general detection bait stations were serviced as often as time allowed starting June 20 and ending August 10. Traps were generally emptied every 3-4 days. A total of 8,736.650 adult JB were collected from the 579 detection bait stations during this period. This is an average of 15,089 JB per trap. (See attachment 4).

A special Research and Development (R&D) study with 100 bait stations was conducted to determine if bait stations plus regular 7 day applications of Sevin to indigineous host plants at trap sites was more effective than the general detection traps alone. Traps, pheromone and lure for the R&D survey were identical to the general detection bait stations.

The R&D bait stations were set out in 10 groups of 10 traps each at or near selected plantings of host plants or weed areas on McGuire AFB and Fort Dix. Two bait stations in each group of 10 were controls and eight were study traps. The R&D study traps plus indigenous foliage for at least 15 feet surrounding each trap was sprayed with Sevin 80S every seven days Control traps and surrounding foliage were not sprayed.

Three study plots of one square foot each were permanently marked on the turf near each of the 100 R&D traps Dead JB were counted once each week in all of those turf plots (See attachment#5).

The R&D bait stations were serviced and emptied every day, except Sundays, from July 2 through August 17. (See attachment #6) a total of 2,737 562 JB were collected from the 100 R&D bait stations. This works out to an average of 27,376 per bait station, almost double the per trap rate for the detection traps serviced on 3 - 4 day intervals.

3) Special Information

McGuire AFB was declared regulated for JB to prevent their spread by aircraft for the period June 25 through August 10.

The McGuire Civil Engineering Squadron had the whole base sprayed with Sevin 4 - oil by aircraft on July 17.

Visual observations of JB flights on aircraft parking- loading ramp and around traps were made on a regular basis by HEM Jr. in order to compare with previous seasons

CONCLUSIONS

1) 679 bait stations plus selective applications of Sevin to plant foliage will not control the adult JB population at McGuire enough to prevent the base from being regulated for JB by USDA quarantine.

2) Bait stations will collect twice as many JB if they are serviced on a daily basis instead of a 3 - 4 day interval.

3) Bait stations baited with Pheromone and liquid PEP lure are 3 times as effective as bait stations baited with PEP lure alone. 1978 season data showed 700 bait stations with liquid PEP lure alone collected 4,193, 300 JB compared to the 1979 season grand total of 11,474,212 JB from 679 bait stations.

4) Bait stations, selective foliar applications of Sevin and regulated aircraft treatments are effective in prevention of artificial spread of JB by aircraft from McGuire. California transit inspections information - to date shows no live JB found in aircraft originating or transiting McGuire.

5) Visual inspections of adult JB at McGuire in the summer of 1979 showed the following:

a) Reduced numbers of JB flying, in aircraft, on ramp and in the area compared to 1978. Estimated 90% reduction in JB around aircraft.

b) Marked increase in numbers of JB flying around the bait stations with pheromone and lure as compared to lure only in 1978. My estimate is that 1979 bait stations were 5 to 10 times as attractive as the 1978 variety.

c) More dead JB on the ground around bait stations, along the edge of aircraft parking ramp and in the vicinity of cargo and passenger terminals.

6) The incomplete fall larval counts are greater than the spring counts. My prediction is for a larger JB adult population for Summer 1980 than 1979.

7) The Civil Engineering Squadron, at this time, are not planning for a larval treatment to the base turf areas.

8) The data collected from the plots at the R&D bait stations is insignificant. It does show that there were large numbers of dead JB at or near the Sevin treated foliage.

ANALYSIS

Conclusions from my visual observations are that the pheromone-lure type bait stations are 5-10 times more effective as a source reduction for JB compared WITH the lure type bait station. The 679 pheromone bait stations were not enough of a source reduction to keep the base from being regulated for JB. Additional bait stations, daily servicing and selective foliage applications might give the source reduction necessary for adquate population management at McGuire.

Harry E. Mumma, Jr.

Harry E. Mumma, Jr.
Officer in Charge

UNITED STATES DEPARTMENT OF AGRICULTURE
SCIENCE AND EDUCATION ADMINISTRATION

FEDERAL RESEARCH
NORTH CENTRAL REGION

Japanese Beetle Research Laboratory
Ohio Agriculture Research and
Development Center
Wooster, Ohio 44691

February 9, 1979

Subject: McGuire AFB larvae resistance to chlordane

To: Cy Sanders
USDA, APHIS
NJ Dept. of Health & Agriculture
Bldg., Rm 205-F
John Fitch Plaza, Box 1
Trenton, NJ 08601

A week ago today I set up a test similar to the previous test, using the latest sample of grubs sent to me on 1/23/79. It appears that the reaction to 6, 30, and 60 ppm chlordane is following the same curve as the McGuire grubs previously tested.

In addition to the above, I added a 600 ppm dose (considered equivalent to 600 lb, ai/acre). After 7 days, 100% of the (susceptible) control larvae are dead, while all of the McGuire larvae appear normal and healthy!

I will maintain these larvae in the 600 ppm for a couple more weeks, before I call the test complete, but survival in 100 times what we would consider the "normal" dosage should be quite convincing.

I would like to know where this last sample of larvae came from, for future reference.

Ken

Ken Lawrence
R.P.E.

CC: C. Schwalbe
W. McLane
J. Kennedy
T. Ladd
C. Gardner
M. L. Cleveland

KL:vjr

ATTACHMENT # 2

1979 Japanese Beetle Spring Larval Survey Results

Block Number & Location	JB Grubs at Site # 1	2	3	4	5	6	7	8	9	10	Date Sampled
1	1	12	4	0	6	5	0	2	6	3	5/8/79
2	0	3	1	3	2	1	1	2	0	3	5/8
3	1	1	3	7	2	7	6	3	1	4	5/16
4	0	0	3	2	0	0	2	0	0	0	5/10
5	0	7	5	6	0	2	0	8	11	15	5/11
6	0	2	2	2	2	2	3	1	2	8	5/16
7	3	6	3	1	13	2	3	0	8	7	5/16
8	1	11	2	2	9	0	7	3	0	0	5/17
9	1	8	2	0	1	3	0	1	1	4	5/2
10	3	1	0	15	2	2	5	0	3	13	4/30
11	0	4	0	5	13	0	0	4	9	3	4/30
12	9	3	5	4	0	0	9	0	4	8	4/30
13	0	9	0	0	0	2	8	2	5	1	5/15
14	1	0	0	0	0	0	1	0	3	2	5/15
15	2	0	3	0	1	1	0	5	3	1	5/11
16	0	1	2	0	0	1	0	2	1	4	5/11
17	5	0	2	1	0	0	3	3	4	1	5/15
18	4	5	9	2	0	0	4	7	3	9	4/26
19	8	5	4	6	2	1	0	1	8	10	4/24
20	1	0	1	3	2	0	2	2	0	1	5/10
21	0	3	2	0	0	2	3	6	0	4	5/10
22	0	1	0	9	9	2	0	1	3	0	5/4
23	12	5	4	6	7	6	0	0	2	2	5/9
24	1	1	0	6	1	4	1	0	0	0	5/16
25	1	0	3	0	0	0	0	0	1	1	5/7
26	0	3	1	2	0	5	1	3	2	1	5/17

1979 Japanese Beetle Spring Larval Survey Results ATTACHMENT 2

Block Number & Map Location	JB Grub Counts at Site # 1	2	3	4	5	6	7	8	9	10	Date Sampled
27	Block not available for Survey										
28	1	3	3	5	6	12	5	3	8	4	5/7/79
29	0	5	14	0	2	0	0	Not available			5/4
30	5	3	0	5	6	14	5	0	5	3	5/17
31	Block not available for Survey										
32	6	0	3	16	0	3	2	5	1	0	5/8
33	0	0	3	2	4	0	9	0	2	4	5/18
34	2	0	3	0	2	2	19	8	6	3	4/25
35	2	6	3	13	16	1	2	3	10	9	4/25
36	2	3	10	2	2	0	0	0	0	5	5/15
37	1	4	5	7	21	0	3	0	4	6	4/26
38	1	7	2	0	8	14	0	15	8	0	4/24
39	0	1	2	16	0	11	5	12	2	3	4/24
40	4	0	9	3	8	7	8	0	3	7	5/2
41	3	0	0	4	0	1	0	8	2	4	5/1
42	3	5	2	5	7	3	2	0	4	6	5/1
43	0	0	4	3	1	0	0	2	2	0	5/1
44	8	4	6	4	6	3	11	1	0	8	5/7
45	2	0	3	0	0	0	0	0	4	0	5/7
46	0	0	0	0	0	1	3	0	1	0	5/7
47	0	0	0	0	0	1	0	0	3	0	5/8
48	1	0	0	0	0	2	3	3	0	0	5/9
49	2	0	0	0	1	0	0	0	0	0	5/9
50	1	2	2	0	11	0	0	0	1	0	5/9
51	14	3	5	7	3	3	0	8	0	2	5/2
52	2	3	1	2	4	5	8	5	2	3	5/2
53	6	3	0	0	2	9	10	5	6	0	5/1

1979 Japanese Beetle Fall Larval Survey Results

Block Number & Map Location	JB Grubs at site # 1	2	3	4	5	6	7	8	9	10	Date Sampled
1	no sample										
2	18	5	0	8	7	0	1	1	4	8	9/12/79
3	no sample										
4	4	1	0	3	1	6	0	2	0	10	9/12
5	no sample										
6	0	0	2	6	1	17	3	2	2	0	9/13
7	3	2	2	2	23	6	7	7	10	8	9/13
8	5	6	10	4	4	3	20	4	11	5	9/13
9	no sample										
10	0	2	7	0	14	1	4	3	4	15	9/19
11	no sample										
12	9	2	0	X	X	1	X	X	X	7	10/24
13	no sample										
14	2	5	5	1	5	3	2	1	2	13	9/18
15	no sample										
16	7	3	X	0	0	0	X	0	X	X	10/24
17	no sample										
18	X	X	X	X	X	0	X	1	X	1	10/24
19	no sample										
20	no sample										
21	3	X	X	2	5	X	0	11	X	X	10/24
22	no sample										
23	1	4	2	11	25	6	2	0	0	14	9/12
24	no sample										
25	8	X	4	0	7	8	X	X	X	4	10/24
26	1	5	X	0	0	X	X	2	X	14	10/24
27	no sample										
28	X	X	1	X	1	X	12	X	0	6	10/24
29	no sample										
30	X	10	X	0	X	2	X	0	X	5	10/24
31	no sample										
32	no sample										
33	1	15	13	1	15	5	12	1	0	2	9/14
34	no sample										
35	1	1	3	0	1	2	11	14	4	5	9/18
36	no sample										
37	0	0	5	0	1	7	3	2	0	1	9/23
38	13	5	1	3	0	2	2	4	3	0	9/23
39	0	6	1	2	4	5	8	4	3	4	9/23
40	no sample										
41	no sample										
42	8	0	3	8	10	5	5	3	8	3	9/20
43	16	2	0	0	0	0	0	1	5	2	9/20
44	no sample										
45	no sample										
46	X	X	X	0	0	2	2	0	X	X	9/20
47	0	1	3	2	11	7	0	11	1	3	9/20
48	no sample										
49	2	3	1	6	0	11	2	3	0	2	9/20
50	0	1	0	3	5	7	8	9	1	0	9/20

X represnts no sample taken

Attachment 4

General Detection Traps

McGuire AFB

8,780,625 JB Captured

Trap Row	# Traps in Row	June 20-30	July 1-10	July 11-20	July 21-30	Aug 1-10
A	65	26,050	336,600	564,300	66,000	82,500
B	29	7,300	52,800	369,600	36,300	46,200
C	60	21,200	49,500	104,000	59,400	17,200
D	37	11,600	26,400	529,700	85,800	28,900
E	24	7,400	134,550	339,900	49,500	36,300
F	38	49,550	120,475	191,400	79,200	38,700
G	31	7,400	68,900	254,200	85,800	26,400
H	36	9,900	191,500	759,000	145,200	58,800
I	36	16,500	156,400	523,100	112,200	85,700
J	22	71,450	73,450	118,800	29,700	19,000
K	71	79,200	249,200	458,550	102,800	35,600
L	23	16,600	69,600	117,800	23,000	29,400
M	41	81,750	81,250	69,300	33,000	16,100
N	40	168,250	188,150	240,900	46,200	50,700
O	26	47,900	72,050	56,500	39,600	15,500
		622,050	1,870,825	4,697,050	1,003,700	587,000

Attachment 5

Total number of dead JB found on 3 1 ft^2 samples near each RD trap.

	Trap Number									
Row	1	2	3	4	5	6	7	8	C_1	C_2
1	52	48	165	32	37	43	54	58	40	20
2	74	44	82	74	48	98	97	74	199	120
3										
4	25	38	56	54	36	36	22	64	32	12
5	60	73	47	47	53	95	81	47	52	15
G	150	207	47	134	115	114	156	124	46	62
H	258	167	186	157	261	323	292	262	171	376
I	166	239	263	208	355	326	205	172	8	28
J	53	69	28	58	82	60	51	78	39	54
K	34	46	37	40	40	42	39	49	17	53
L	29	130	33	27	95	39	49	59	16	13

Total JB captured in RD traps

Row	1	2	3	4	5	6	7	8	C_1	C_2
1	19,499	19,494	19,275	19,633	19,941	19,899	20,677	21,300	26,677	28,937
2	49,996	48,604	44,513	44,867	45,080	48,176	47,192	50,889	54,845	52,192
3										
4	31,525	24,773	35,560	38,062	22,676	17,774	17,556	17,924	16,145	35,069
5	10,855	6,431	8,078	13,299	24,846	28,614	19,193	18,112	13,473	10,985
G	38,617	38,897	35,513	37,401	37,308	34,876	39,188	40,926	40,618	36,929
H	28,182	18,971	28,590	27,099	30,759	29,851	26,797	31,092	31,696	38,632
I	34,080	34,518	36,309	37,522	36,203	32,993	43,976	27,462	26,905	40,426
J	17,718	17,567	18,917	22,183	18,740	18,501	11,873	17,942	21,351	19,663
K	19,613	21,356	20,149	18,386	14,582	19,734	23,464	20,239	21,857	19,098
L	21,076	21,532	19,910	19,814	31,538	18,047	19,552	18,291	23,882	26,015

JAPANESE BEETLE

1979

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED	DATE ANALYSED	PPDDT	PPTDE	PPDDE	OPDDT	DIELDRIN	PHOTO DIELDRIN	CHLORO DANE
0001	[illegible]	SOIL	05-11-79	05-08-79	05-16-79	06-29-79	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	1.96
0002	"	"	"	"	"	"	"	"	"	"	"	"	2.24
0003	"	"	05-16-79	05-16-79	05-21-79	"	"	"	"	"	"	"	Neg.
0004	"	"	05-14-79	05-10-79	"	"	"	"	"	"	"	"	16.64
0005	"	"	"	05-11-79	"	"	"	"	"	"	"	"	10.59
0006	"	"	05/16-79	05-16-79	"	"	"	"	"	"	"	"	3.23
0007	"	"	"	"	"	"	"	"	"	"	"	"	7.62
0008	"	"	05/17-79	05-17-79	"	"	"	"	"	"	"	"	7.46
0009	"	"	05-04-79	05-02-79	05-16-79	"	"	"	"	"	"	"	1.42
0010	"	"	05-04-79	04-30-79	"	"	"	"	"	"	"	"	3.98
0011	"	"	"	"	"	"	"	"	"	"	"	"	4.38
0012	"	"	"	"	"	"	"	"	"	"	"	"	7.04
0013	"	"	05-15-79	05-15-79	05-21-79	"	0.411	0.168	0.169	0.098	0.155	"	Neg.
0014	"	"	"	"	"	"	0.135	0.043	0.129	0.030	0.354	"	"
0015	"	"	05-14-79	05-11-79	05-16-79	"	0.146	0.036	0.077	0.026	0.186	"	"
0016	"	"	"	"	"	"	0.100	0.027	0.068	0 016	0.074	"	"
0017	"	"	05-15-79	05-15-79	05-21-79	"	Neg.	Neg.	Neg.	Neg.	Neg.	"	2.63
0018	"	"	04-27-79	04-26-79	05-04-79	"	"	"	"	"	"	"	3.64
0019	"	"	"	04-24-79	"	"	"	"	"	"	"	"	5.19
0020	"	"	05-14-79	05-10-79	05-16-79	"	"	"	"	"	"	"	10.79
0021	"	"	"	"	"	"	"	"	"	"	"	"	2.54
0022	"	"	05-09-79	05-04-79	"	"	0.159	0.041	0.105	0.033	0.113	"	Neg.
0023	"	"	05-11-79	05-09-79	05-21-79	"	Neg.	Neg.	Neg.	Neg.	Neg.	"	9.39
0024	"	"	05-16-79	05-16-79	"	"	"	"	"	"	0.469	"	Neg.
0025	"	"	05-11-79	05-07-79	05-16-79	"	"	"	"	"	Neg.	"	4.08
0026	"	"	"	"	"	"	"	"	"	"	"	"	2.09
0026	"	"	05-17-79	05-17-79	05-21-79	09-10-79	0.069	"	"	"	0.212	"	1.96
0027	No Sample												
0028	No Sample												
0029	---	SOIL	05-09-79	05-04-79	05-16-79	"	0.267	"	0.125	"	0.142	"	5.58
0030	"	"	05-17-79	05-17-79	05-21-79	"	0.369	"	Neg.	Neg.	0.732	"	4.91
0031	No Sample												
0032	---	"	05-11-79	05-08-79	05-16-79	"	0.369	"	0.249	"	0.397	"	7.98
0033	"	"	05-18-79	05-18-79	05-21-79	"	0.123	"	Neg.	"	0.456	"	8.39
0034	"	"	04-27-79	04-25-79	05-04-79	"	Neg.	"	"	"	10.48	"	9.66
0035	"	"	"	"	"	"	0.789	"	0.349	"	1.00	"	8.41
0036	"	"	05-15-79	05-15-79	05-21-79	"	0.264	"	0.131	"	0.089	"	3.21
0037	"	"	04-17-79	04-26-79	05-04-79	"	0.163	"	0.064	"	0.248	"	2.55
0038	"	"	04-27-79	04-24-79	"	"	0.045	"	0.045	"	0.061	"	0.582

JAPANESE BEETLE

1979

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED	DATE ANALYSED	PPDDT	PPTDE	PPDDE	OPDDT	DIELDRIN	PHOTO DIELDRIN	CHLOR DANE
0039	---	SOIL	04-27-79	04-24-79	05-04-79	07-02-79	0.203	Neg.	Neg.	Neg.	7.51	0.200	3.81
0040	"	"	05-04-79	05-02-79	05-16-79	09-10-79	0.476	"	0.331	"	0.341	"	5.76
0041	"	"	"	05-01-79	"	"	0.320	0.319	Neg.	"	0.834	"	3.62
0042	"	"	"	"	"	"	0.107	Neg.	0.061	"	0.126	"	0.926
0043	"	"	"	"	"	"	0.137	"	0.111	"	0.323	"	1.14
0044	"	"	05-11-79	05-07-79	"	07-02-79	0.336	"	0.222	"	0.423	"	4.55
0045	"	"	"	"	"	"	0.980	"	0.640	"	2.53	0.149	1.68
0046	"	"	"	"	"	"	0.200	"	0.083	"	0.600	0.072	0.469
0047	"	"	"	05-08-79	"	"	0.200	0.036	0.088	0.039	1.71	0.170	0.179
0048	"	"	"	05-09-79	"	"	0.108	Neg.	0.046	Neg.	0.078	Neg.	Neg.
0049	"	"	05-11-79	"	"	"	0.106	0.031	0.025	0.020	1.08	0.027	"
0050	"	"	"	"	"	"	0.087	0.038	Neg.	0.016	2.36	0.25	0.09
0051	"	"	05-04-79	05-02-79	"	"	0.062	0.036	"	0.014	0.873	0.224	0.19
0052	"	"	"	"	"	"	0.066	Neg.	"	Neg.	0.367	Neg.	2.71
0053	"	"	"	05-01-79	"	"	0.055	"	0.056	"	0.162	"	1.53

U.S. DEPARTMENT OF AGRICULTURE

Memorandum

ANIMAL AND PLANT HEALTH INSPECTION SERVICE
Plant Protection & Quarantine
1201 Corbin Street
Elizabeth, NJ 07201

SUBJECT: Annaul Japanese Beetle Report for 1979

DATE: November 23, 1979

TO: Winfred H. McLane
Otis Methods Development Center
Otis AFB, MA

The 1979 Japanese Beetle Program got under way with grub sampling on March 13th. In many spots the grub count was either minimal or non-existent. The unseasonable cold and windy weather along with poor turf areas were the probable causes of this. Grub counts in the favorable turf areas ranged from 10-24 per sample. Well cultivated areas in front of the terminals resulted in the highest grub counts. Runways and cargo areas had the lowest counts.

On March 20th, 35 soil samples were taken prior to soil application. The soil samples were taken to determine the presence of residual insecticides and then packaged and mailed to Gulfport for analysis.

The soil application of Dasanit began on March 29th over the 8 test plot sites previously determined by Ken Lawrence. Rain, cold winds and machinery breakdowns and repairs consistently held up the applications. A seed hopper and hand spreaders were primarily used to apply Dasanit. A buffalo turbine was also used. Its use, however, was limited due to the agitators breaking the Dasanit pellets into a fine powder which plugged the apertures and was heavily influenced by the wind factor. It stopped working a short time after and was not used again. On May 1st all spreading was finally completed. Approximately 462 acreas were treated with 7,850 lbs. of Dasanit. The original acreage for treatment was given as 700, but was reduced through visual inspections and negative grub counts.

On May 2nd, the 2nd collection of soil samples was taken, packaged and sent forward for analysis. Arrival in Gulfport was delayed due to an insufficient number of mailing boxes being provided.

Beetle traps arrived on May 23rd followed by the Pheromone on the 25th. Stakes for the beetle traps were located in strategic areas as suggested by the Port Authority and PPQ personnel. Quarantine labels were affixed in an attempt to deter pilferage. Out of 96 traps set out, only to remained at seasons end. The traps were emptied and also re-baited when necessary. A total of 40 lbs. of beetles were removed from the traps.

When the adult season arrived, USDA and the Port Authority were out checking around the cargo and plane blocking areas for the presence of

live beetles. Airline representatives also were looking for us. No alive adults were seen during this time. Foliar spraying with Sevin occured when heavy numbers of adults were noted. The perimeter traps were a helpful aid in determining the necessity for spraying. A total of 1300 lbs of Sevin was applied between June 14th and Aug. 17th.

A total of 53 planes were sprayed due to their ultimate destination in one of the seven western states and transiting regulated airports. 8 Northwestern flights were treated with Phenothrin between July 18th and the 25th. Adequate jetways as per Philadelphia, terminated spraying requirements at this time. Transworld Airlines treated 45 daily flights between july 10th and Aug. 23rd.

The 1978 season at Newark was handled primarily through the Port Authority of N.Y. & N. J. and PPQ. A Foliar spray of Sevin only was applied in an attempt to cut down the adult population. Some of the spraying was actually done by PPQ personnel. Need for spraying was determined through visual inspections by personnel involved. Newark was not determined hazardous for 1978. In October of 78, Newark was included in the Japanese Beetle Workshop conducted in Philadelphia. Newark was to be included as a test airport for soil treatment in 1979.

The 1979 season was very successful considering weather and man power conditions. Frequent rain and wind made grub sampling, soil application and post treatment inspections difficult to complete. The late arrival of Dasanit did little to aid the program. Only three aides were present to carry labor necessities, resulting in too much use of Port PPQ officers. Machinery too, was insufficient to apply Dasanit within the prescribed time. The adult population, however, appears to be well under that of 1978 and less Sevin was used this year than in 1978.

Projections for 1980 should include at least as much, or more funding to adequately carry out the program. The capacity for purchasing additional machinery and personnel would greatly enhance a successful completion of all treatment procedures. It is also sugessted that port PPQ officers carry out the program due to their availability and already existing experience.

Donald T. Baker

Donald T. Baker
Supr. PPQ Officer

ESSEX, N. J.

JAPANESE BEETLE

1979

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED	DATE ANALYSED	PPDDT	PPTDE	PPDDE	OPDDT	DIELDRIN	PHOTO DIELDRIN	CHLORO DANE
000A	---	SOIL	04-12-79	05-02-79	05-29-79	07-30-79	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
000B	"	"	"	"	"	"	"	"	"	"	"	"	"
000C	"	"	"	"	"	"	"	"	"	"	"	"	"
000D	"	"	"	"	"	"	"	"	"	"	"	"	"
000G	"	"	"	05-03-79	"	"	0.030	"	"	"	"	"	"
000H	"	"	"	"	"	"	Neg.	"	"	"	"	"	"
000J	"	"	03-29-79	05-02-79	"	"	"	0.010	0.011	"	"	"	"
000K	"	"	04-12-79	05-03-79	"	"	0.018	0.012	0.015	"	"	"	"
000L	"	"	"	"	"	"	0.023	Neg.	0.013	"	"	"	"
000M	"	"	"	"	"	"	Neg.	Neg.	Neg.	"	"	"	"
000O	"	"	"	05-02-79	"	"	0.025	0.018	0.009	"	0.005	"	"
000P	"	"	03-29-79	"	"	"	Neg.	Neg.	Neg.	"	Neg.	"	"
000Q	"	"	03-30-79	"	"	"	"	"	0.025	"	0.015	"	0.126
000T	"	"	04-12-79	05-03-79	"	"	0.032	0.031	0.014	"	0.003	"	Neg.
000U	"	"	04-14-79	05-04-79	"	"	0.034	0.015	0.015	"	Neg.	"	"
000V	"	"	04-16-79	05-03-79	"	"	Neg	Neg.	Neg.	"	"	"	"
000W	"	"	"	"	"	"	"	"	"	"	"	"	"
000X	"	"	04-14-79	05-04-79	"	"	"	"	"	"	"	"	"
000Y	"	"	04-16-79	05-03-79	"	"	0.035	0.022	0.011	"	0.002	"	"
000Z	"	"	04-12-79	05-02-79	"	07-23-79	Neg.	Neg.	Neg.	"	Neg.	"	"
00A1	"	"	"	05-03-79	"	"	"	"	"	"	"	"	"
00C1	"	"	"	"	"	"	0.024	"	0.011	"	0.044	"	"
00E1	"	"	04-14-79	05-07-79	"	07-30-79	Neg.	Neg.	Neg.	Neg.	0.015	"	"
00H1	"	"	"	"	"	"	0.325	"	0.055	0.061	0.638	"	"
00J1	"	"	04-12-79	05-04-79	"	"	Neg.	"	Neg.	Neg.	Neg.	"	"
00K1	"	"	"	"	"	"	"	"	"	"	"	"	"
00L1	"	"	"	"	"	"	"	"	"	"	"	"	"
00M1	"	"	"	05-07-79	"	"	"	"	"	"	"	"	"
00M1	"	"	"	"	"	"	0.025	0.013	0.003	"	"	"	"
00O1	"	"	04-14-79	05-04-79	"	"	0.029	0.012	0.017	"	"	"	"
00P1	"	"	04-16-79	05-07-79	"	"	0.082	0.012	Neg.	"	2.19	0.007	"
00Q1	"	"	"	"	"	"	2.09	0.076	0.738	0.171	1.65	0.014	"
00T1	"	"	"	"	"	"	5.02	0.582	1.04	2.67	0.687	0.013	"
00U1	"	"	"	"	"	"	Neg.	Neg.	Neg.	Neg.	0.235	Neg.	"
00V1	"	"	04-14-79	"	"	"	"	"	"	"	0.035	"	0.355

Essex, N.Y.

JAPANESE BEETLE

1979

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED	DATE ANALYSED	PPDDT	PPTDE	PPDDE	DIELDRIN	PHOTO DIELDRIN	Chloro-drate
000A	PRE-TREAT	SOIL	----	03-20-79	04-02-79	07-02-79	NEG.	NEG.	NEG.	NEG.	NEG.	
000B	"	"	"	"	"	"	"	"	"	"	"	
000C	"	"	---	"	"	"	"	"	"	"	"	
000D	"	"	---	"	"	"	"	"	"	"	"	
000G	"	"	---	"	"	"	"	"	"	"	"	
000H	"	"	---	"	"	"	"	"	"	"	"	
000J	"	"	---	"	"	"	0.058	0.042	"	"	"	
000K	"	"	---	03-21-79	"	"	NEG.	NEG.	"	"	"	
000L	"	"	---	"	"	"	"	"	"	"	"	
000M	"	"	---	"	"	"	"	"	"	"	"	
000O	"	"	---	"	"	"	0.042	"	0.016	"	"	
000P	"	"	---	"	"	"	NEG.	"	NEG.	"	"	
000Q	"	"	---	"	"	"	"	"	"	"	"	
000T	"	"	---	"	"	"	0.022	"	"	"	"	
000U	"	"	---	"	"	"	NEG.	"	"	"	"	
000V	"	"	---	"	"	"	"	"	"	"	"	
000W	"	"	---	"	"	"	"	"	"	"	"	
000X	"	"	---	"	"	"	0.066	0.033	0.016	"	"	
000Y	"	"	---	"	"	"	NEG.	NEG.	NEG.	"	"	
000Z	"	"	---	"	"	"	"	"	"	"	"	
00A1	"	"	---	"	"	"	0.042	"	0.007	0.017	"	
00C1	"	"	"	"	"	"	NEG.	"	NEG.	NEG.	"	
00E1	"	"	---	"	"	"	"	"	"	"	"	
00H1	Pre-Treat	Soil	—	03-21-79	04-02-79	06-29-79	8.84	1.00	0.964	0.035	Neg.	Neg.
00J1	"	"	—	03-22-79	"	"	Neg.	Neg.	Neg.	Neg.	"	"
00K1	"	"	—	"	"	"	"	"	"	"	"	"
00L1	"	"	—	"	"	"	"	"	"	"	"	"
00M1	"	"	—	"	"	"	"	"	"	"	"	"
00N1	"	"	—	"	"	"	"	"	"	"	"	"
00O1	"	"	—	"	"	"	"	"	"	"	"	"
00P1	"	"	—	"	"	"	"	"	"	0.685	0.011	"
00Q1	"	"	—	"	"	"	"	0.436	0.855	2.900	"	"
00T1	"	"	—	"	"	"	0.447	0.043	Neg.	1.33	0.419	"
00U1	"	"	—	"	"	"	Neg.	Neg.	"	0.038	Neg.	"
00V1		"	—	"	"	"	"	"	"	0.078	"	0.666

JAPANESE BEETLE

1979

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED	DATE ANALYSED	PARA-THION	ETHION
000C	---	SOIL	04-12-79	05-02-79	05-29-79	07-30-79	Trace	Neg.
000D	---	"	"	"	"	"	Neg.	0.070
000Q	"	"	03-30-79	"	"	"	Trace	Neg.
000V	"	"	04-16-79	05-03-79	"	"	0.40	Neg.
000W	"	"	"	"	"	"	Neg.	0.077
000X	"	"	04-14-79	05-04-79	"	"	"	0.510
00H1	"	"	"	05-07-79	"	"	0.032	0.550
00O1	"	"	"	05-04-79	"	"	Trace	Neg.
00P1	"	"	04-16-79	05-07-79	"	"	0.260	1.53
00Q1	"	"	"	"	"	"	Neg.	0.170
00T1	"	"	"	"	"	"	"	0.160

U.S. DEPARTMENT OF AGRICULTURE PLANT PROTECTION AND QUARANTINE

Memorandum

Philadelphia, Pa.

SUBJECT Summary of Japanese Beetle Program
Port of Philadelphia 1979

DATE: October 26, 1979

TO Wir McLane
Methods Development Laboratories
USDA, Otis Air Force Base
Massachusetts

In complying with your telephone request, the following is a brief summary of our Japanese Beetle Program at Philadelphia International Airport during the summer of 1979:

In November 1978, at a workshop held at Best Western Motel, Philadelphia, we learned that we would be treating PIA for JB in the spring of 1979 with a new insecticide, OFTANOL (Amaze). As a first effort we drafted a work plan for this project entitled Management of Japanese Beetle Populations in and around PIA (JB 9.1.1E). This was submitted February 8, 1979, and listed our objectives as -

A. Monitor the spring grub population using a grid system prescribed by the Environmental Evaluation staff.

B. Treat 1,600 acres with Amaze (Oftanol) to establish efficacy and evaluate its potential use in the general program.

C. Make a determination as to how effective the program was in detering the flight of adult Japanese beetles in and around aircraft and docking areas. This will be determined by monitoring adult populations found in traps which will be positioned at the airport.

The methods to be employed, estimated costs, and personnel needs were also listed.

In January 1979, Win McLane, Jack Henderson and I met at PIA with Mr. C. H. Rogers, Mgr. of Opns, Division of Aviation, and Bruce Ware, Opns. Mgr. , FAA Control Tower to establish procedures and requirements for aerial applications of insecticides.
As the spring and summer approached, other needs, over and above our initial work plan surfaced in the February 8, 1979 Work Plan which was returned to us. Such additions included the shipping of grub samples for chemical analysis, shipping of soil samples for chemical analysis, later the request to place petri dishes in planes to collect possible residue; these to be forwarded for analysis; and fall grub survey.

One aid was hired for the summer months. His first tasks consisted of placing 144 adult JB traps and taking 520 soil samples to determine JB grub populations. The first traps were in place June 19, and the first adults were trapped June 25th On June 26, this office mailed letters to involved airlines explaining the situation and alerting them to the possibility of "regulating" the airport if populations demanded it. On July 1st, the first sighting of adults in the concourse area occurred and PIA was regulated for JB on July 2, 1979.

In mid-March, Win McLane, Jack Henderson, K. Lawrence and I met at the airport with Joseph Vita, Airport Superintendent and Bohdan

Korzeniowski, Dept of Commerce Project Manager to finalize plans and procedures during treatment by aircraft.

Emergency Action notices were executed and begining July 2, were taken to involved airlines for signature and compliance. Letters to the airlines explaining the need for the action were mailed from our Area Office July 9, 1979.

Our aid, in addition to monitoring the traps, was also asked to run some tests using adult beetles in traps which he did.

Again, this was a function which we were not aware of and it was not included in our work plan

Comparison of the spray and fall grub survey indicated for fewer grubs present in the soil in September except for one area where counts were high.

During the regulated period July 2nd to August 16th, all aircraft departing Philadelphia for any of the designated western states were either treated with the aerosol d-phenothrin, or after July 25, were employing the "mechanical barrier" technique which was approved by our Hyattsville office. In July Mr. Joe Ford from Gulfport Laboratory stopped in the office to leave some petri dishes and requested they be placed on aircraft being treated so that the amount of residue could be determined.

Three foliar applications were made during the regulated period also.

As an added precaution, an additional application of Amaze to perimeter areas just outside the airport proper was applied using a buffalo turbine during the last week in September.

Reports received from California indicate that fever JB were found in 1979 then were recovered in 1978.

Summary of treatments:

Air - 1206 Acres using 16,040 lbs. Amaze

Ground - 226½ Acres using 2,950 lbs. Amaze (2 applications)

Ground - 110 Acres using Sevin 80S (3 applications)

D. L. McCullough
Officer In Charge

cc: J. Katsanos
E. Eckess

Attch: 2

DELAWARE, PA. JAPANESE BEETLE

SITE NO.	TREATMENT	TYPE OF SAMPLE	DATE OF APPLICATION	SAMPLING DATE	DATE RECEIVED (1979)	DATE ANALYSED (1979)	PPDDT	PPTDE	PPDDE	OPDDT	DIELDRIN	PHOTO DIELDRIN	CHLORDANE
0001	----	SOIL	---	03-26-79	03-30-79	06-29-79	Neg.	Neg.	Neg.	Neg.	0.200	0.117	Neg.
0002	"	"	"	"	"	"	"	"	"	"	0.293	0.011	0.512
0003	"	"	"	"	04-13-79	06-29-79	"	"	"	"	0.370	0.013	"
0004	"	"	"	"	04-02-79	"	"	"	"	"	0.193	Neg.	"
0005	"	"	"	03-27-79	"	"	"	"	"	"	0,408	0.086	"
0006	"	"	"	"	"	"	"	"	"	"	0.044	Neg.	"
0007	"	"	"	"	"	"	"	"	"	"	Neg.	"	"
0008	"	"	"	"	"	"	"	"	"	"	0.265	Trace-	" "
0009	"	"	"	03-30-79	03-30-79	"	"	"	"	"	0.032	Neg.	"
0010	"	"	"	"	"	"	"	"	"	"	Neg.	"	"
0001	"	"	"	"	04-02-79	"	"	"	"	"	"	"	"
0002	"	"	"	"	"	"	"	"	"	"	"	"	1.45
0003	"	"	"	04-06-79	04-12-79	"	"	"	"	"	0.033	"	Neg.
0004	"	"	"	"	"	"	"	"	"	"	0.168	"	"
0005	"	"	"	"	"	"	"	"	"	"	0.170	0,017	"
0006	"	"	"	"	"	"	"	"	"	"	0.173	0 030	"
0007	"	"	"	"	"	"	"	"	"	"	Neg.	Neg.	"
0008	"	"	"	"	"	"	"	"	"	"	"	"	"
0009	"	"	"	"	"	"	1.82	0.917	1.20	2.17	0.687	0.011	"
0010	"	"	"	"	05-10-79	07-02-79	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	"
0011	"	"	"	"	"	"	"	"	"	"	0.034	"	"
0001	"	"	"	04-09-79	"	"	"	"	0.022	"	0.021	"	"
0002	"	"	"	"	"	"	"	"	Neg.	"	0.191	"	"
0003	"	"	"	"	"	"	"	"	"	"	0.007	"	"
0004	"	"	"	04-02-79	"	"	"	"	0.008	"	0.009	"	"
0005	"	"	"	"	"	"	"	"	Neg.	"	Neg.	"	"
0006	"	"	"	"	"	"	0.053	0.008	0.025	0.010	0.027	"	"
0007	"	"	"	"	"	"	Neg.	Neg.	Neg.	Neg.	0.553	"	"
0008	"	"	"	"	"	"	"	"	"	"	0.005	"	"
0009	"	"	"	"	"	"	"	"	"	"	Neg.	"	"
0010	"	"	"	"	"	"	"	"	"	"	"	"	"
0011	"	"	"	"	"	"	"	"	"	"	0.014	"	"